Master’s thesis

Wage Distribution and the Business Cycle in Germany

by

Mads R. Hansen

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Supervisors:
Eckhard Hein, Berlin School of Economics and Law, Germany
Marc Lavoie, University of Ottawa, Canada

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Abstract

Aim of the paper is to understand whether the aggregative empirical study of demand regimes in Germany is biased towards finding profit-led results when the wage-share is not disaggregated in overhead- and direct labour, and whether its results are robust to periodicity and length of the data analysed.

After providing a brief review of the theoretical and empirical literature on demand and distribution as well as within wage differences and overhead labour, I follow the empirical strategy of aggregative/systemic estimation in determining aggregate demand- and distributive-regimes simultaneously by analysing feedback effects of the variables onto each other and themselves. Structurally restricted Vector Auto Regressions (SVARs) are estimated for two datasets. First in quarterly periodicity from 2007-2021 and second, in annual periodicity from 1991-2017. By comparing the obtained Aggregated Impulse Response Functions (AIRFs) of a baseline model with an alternative model, disaggregating the wage-share in the shares of supervisory and direct labour for the short- and medium-term, interpretations will be drawn. All results are tested for their sensitivity to theoretical assumption on the contemporaneous effects of variables onto each other by imposing structural restrictions inspired by the neo-Goodwinian narrative and testing these results sensitivity by comparison with an alternative ordering following a rather post-Kaleckian narrative.

I find support for the hypothesis that disaggregating the wage-share is important for empirical studies of the demand and distributive regimes. Studies might be biased towards finding (stronger) profit-led results and a procyclical wage-share when omitting personal income distribution and the special role of overhead labour. When conducting VAR estimates, structural restrictions ought to be carefully chosen, as they can drastically change the results of the AIRFs, often in support of the respective theory. While in the short-term and the disaggregated baseline model both find support for their respective theories (neo-Goodwinian: procyclical vs post-Kaleckian: countercyclical wage-share) these differences disappear when disaggregating the wage-share in the medium-term. The slight profit-squeeze found in the aggregated model under 'G'-ordering is driven by the supervisory-wage-share.

Researchers must pay special attention to the timeframe and coarseness of data chosen. The found results can be interpreted in favour of those arguing for profit-led demand regimes in the short-term and wage-led demand regimes in the medium-term, but these findings could be also due to other problems in the methodology like endogenizing exogenous effects and temporal identification problems, especially in presence of wage-, employment-hysteresis and changing claims of social classes.

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1. Introduction

My lifetime on this planet is characterized by recurrent and seemingly escalating crises, be it wars, environmental-, economic-, political-, health-, or humanitarian-crises. The euphoria after the end of the so called cold-war, smelling world-peace, economic growth through trade and liberal societies all over the world, switched to a global hangover lasting now over 10 years for those who enjoyed the nectar of triumph to have won in the battle of systems. Low productivity- as well as GDP-growth, this double-edged sword promising better conditions of life, while, without proper decoupling from its emissions, simultaneously destroying the bases of all human life on this planet, posed a challenge to the welfare state and social contract in many European economies. The Federal Republic of Germany, in which I grew up, was particularly hit by the end of the cold war and its ‘reunification’. The challenge of integrating seemingly unproductive workers in the former German Democratic Republic into the economy struck the last nail in the coffin of Keynesian inspired economic policy (which was never particularly admired in Germany) and paved the way for a number of reforms ‘liberalizing’ the labour market, weakening trade-unions and introduce neoliberal, supply oriented policies, like so many countries at that time.

How to foster growth is one of the dominating topics of economics after the second world-war. Several economical schools have claimed superiority in their explanation of economic growth and/or the business cycle. Beginning (this tale) with knives-edge models of Harrod and Domar (Domar, 1947; Harrod, 1939) it was an ever ongoing battle of ideas between demand oriented ‘keynesian’ and supply oriented ‘(neo-)classical’ economists like Solow (Solow, 1956). While the mainstream of economics developed numerous forms of synthesis of demand and supply theories (new-Keynesian/neo-Classical) and claim with their general equilibrium models that perceived business cycles exist rather as reactions to a variety of external (exogenous) shocks to the economy, several heterodox approaches survived or re-emerged to challenge this assumption and develop the old idea of endogenous cycles further.

Two branches are especially relevant for the forthcoming discussion, taking inspiration from Marxian and Kaleckian traditions. Their origins lie on both sides of conflict already introduced above, which is dividing economics since the great depression: Whether the economy is ultimately demand constrained or supply constrained. But both variants discussed in this work are unified under the large umbrella of post-Keynesian economics and rather ask which component of aggregate demand governs economic activity: Investment or consumption demand?

In most modern heterodox (closed economy) models the investment decision is determined by the expected profitability, which in turn depends (at least partially) on the realized profitability. Consumption demand in turn depends on the propensity to consume additional income, often in the form of wages. This ties the question of the total effect of aggregate demand to that of distribution between the factors of production. Usually, receivers of the income from profits and from wages are theoretically differentiated in social classes of capitalists (who receive profits) and workers (who receive wages). As wages are a cost from the position of the capitalists, who decide on investment, a trade-off becomes apparent.

The literature has developed the notion of demand-regimes to grasp this conflict systematically. When redistribution from the wage-share to the profit-share increases aggregate demand, proxied by capacity utilization, then demand is seen as profit-led, vice-versa wage-led (Blecker & Setterfield, 2019; Hein, 2014).

Numerous investigations were conducted to test the different variants of the theory but they produced inconclusive results which were dependent on the empirical method employed (Blecker & Setterfield, 2019, pp. 240–244). Marc Lavoie amongst other Post-Kaleckian authors (Lavoie, 2009a; Lavoie & Nah, 2020) has argued that this is due to theoretical shortcomings and introduced a theory of long-run growth dependent on autonomous-expenditures and short run fluctuations governed by productivity effects due to the existence of overhead labour, which is assumed to be a relatively fixed cost for capitalists, while direct-wage cost is rather flexible over the cycle. Furthermore, Blecker (Blecker, 2016) has stressed the importance of time-frame and periodicity for empirical analysis, as the cost-effects experienced by capitalists through (relative to productivity) rising wages might have immediate effect, while consumption effects might take longer to manifest. Building on these critiques, this thesis attempts to answer the question whether the aggregative empirical study of demand regimes in Germany is biased towards finding profit-led results when the wage-share is not disaggregated in overhead- and direct labour and whether its results are robust to periodicity and length of the data analysed.

Answering this question is highly important for developing more sophisticated theories and enhance our understanding regarding the cyclicality of economies and advise suitable policies. Inspired by (Cauvel, 2019) and especially (Nogueira Rolim, 2019) this work provides first evidence for the relationship between possible procyclical productivity- as well as more nuanced demand feedback-effects through the existence of overhead labour outside of the USA.

Two datasets differentiating overhead- and direct-labour in Germany are assembled. First, to investigate short-term effects, by compiling data from the "quarterly wage surveys" which exists in quarterly periodicity between 2007-2021. Secondly, to extend the high-quality data on overhead labour from the survey to a longer timescale, annual income tax data from 1971-2017 is utilized to approximate the overhead wage-share by the top 10% wage-earners, as the in depth-study of the quarterly income survey revealed that 10% of the employed population are supervisors, which on average earn the highest wages.

For both datasets Structural Vector Auto Regressions (SVARs) are estimated and the obtained impulse response functions of the base-line model (wage-share, capacity utilization) and the alternative model (capacity utilization, supervisory-wage-share, direct-wage-share) are compared. To test the robustness of the findings to theoretical assumptions of contemporaneous causality, the traditional (Goodwinian) structure is compared to an alternative structure of causality, suggested by post-Kaleckian authors (Lavoie & Nah, 2020).

The next section will present a literature review introducing the debates on factor-shares, the business cycle and growth as well as within distribution of wages and its impact on the former theoretically and empirically before in the third section will present methodology and empirical analysis for the short and the long-term, discussing the obtained results in section four and conclude the inquiry in section five.

2. Literature Review

2.1. Factor Shares, the Business Cycle and Growth

While the neo-classical standard model assumes that, in equilibrium, capital and labour receive compensation according to their marginal productivity, economists of various other schools attempt to endogenize the shares of wages and profits in surplus value production to social structures and power relations which renders the relationship between factor shares and aggregate demand to a question of social conflict. In order to limit the scope of the following section, the long history of thought regarding the matter is limited timely to theories popularized after the second world-war, spatially mainly to the centres of capitalist production and in terms of schools of thoughts to those building on the works of Karl Marx, John M. Keynes, Michał Kalecki and Josef Steindl, broadly termed "Post-Keynesian".

2.1.1. Theoretical

By the end of the second world-war, after the experience of the break-down of the gold-standard, liberalizations of economies around the world and several devastating economic crises, resulting in or at least contributing to, two wars with world-wide scope (Polanyi, 1946), Keynes "General Theory" (Keynes, 1936) promised a way out of the miseries of crises prone capitalism by countercyclical government spending and arguing that wage increases could, through demand multiplier effects, make up for the rising wage-cost experienced by capitalist by increasing the level of capacity utilization. As Stephen Marglin and Amit Bhaduri put it in 1988 *"If demand is high enough, the level of capacity utilization will in turn be high enough to provide for the needs of both workers and capitalists. The rate of profit can be high even if the profit margin and the share of profit in output are low and the wage rate correspondingly high."* (Marglin & Bhaduri, 1988). This narrative was welcomed by many, mainly social-democratic, governments around the world resulting in so called "cooperatist" growth models which characterized the "golden age" after the second world war. By the end of the 1970s however, growth-rates dwindled and one theory, this time of Classical/Marxian origins, was already waiting to explain this fact by the profit-squeeze argument.

Richard Goodwin formalized a simple model of the business cycle following, but extending, Karl Marx ideas in 1967 (Goodwin, 1967, 1982) utilizing a predator-prey model developed for biology to understand the complex relationship of two interacting populations of animals (Lotka, 1920; Volterra & Brelot, 1931). It depicts workers as the predator and employment as the prey. With increased economic activity employment rises which improves the bargaining power of workers as the “reserve-army” of unemployed shrinks. If wages rise stronger than productivity (assumed in the model to be increasing in a fixed rate through technical progress) profit rates fall, which leads to a downturn (or crises of accumulation) observable by lower or negative rates of accumulation which induces unemployment. This in turn restores the profit rates as wages fall relative to productivity and lays the ground for the next cycle. Additional to the already mentioned assumption of a fixed rate of productivity increases, the model also requires a constant output to capital ratio, Says-law to hold and assumes full capacity utilization. It produces a long-run trend given by the rate of technical progress and a cyclical movement of accumulation produced by a clockwise movement of the economy in the employment - wage-share - space.

Those scholars influenced by the works of Michał Kalecki (Kalecki, 1971) elevated their theories from the constraints of assuming (perfect) competition, as earlier Keynesians did, and introduce oligopolistic and monopolistic competition (mark-up-/cost-plus-pricing). In these models Investment is determined by expected profits and modelled as a function of current profitability and capacity utilization. These models integrate cost effects of wages (diminishing current profitability) as well as demand effects (increasing capacity utilization) into the investment function leading to the possibility of different demand regimes, dependent on the aggregated effects of both demand components. Two strains of literature arose on the lines of these explicit and more advanced investment functions, which we will call in the following neo-Kaleckian and post-Kaleckian (Hein, 2017):

In the early 80s Amitava Krishna Dutt (Dutt, 1984) and Bob Rowthorn (Rowthorne, 1981) develop independently from each other and inspired by Kaleckis companion Josef Steindl (Steindl, 1975) the base-models of the neo-Kaleckian strain. Investment is formulated as linearly dependent on the rate of profit and capacity utilization, mediated by some factors, e.g., animal spirits.

Later Bhaduri and Marglin criticized this investment function as imposing “unwarranted restrictions on the relative response of investment to the two constituents of the profit rate, [profit share and capacity utilization], with the result that the possibility of profit-led expansion is ruled out" (Bhaduri & Marglin, 1990) and suggest an alternative incorporating the share of profits, instead of its (global/average) rate, as well as capacity utilization as separate arguments in the investment function (see also Kurz, 1991):

$$I = I(h, z), \quad I_h > 0, I_z > 0$$

The obtained model is quite versatile (Hein, 2017): it is able to produce many (although not all) results consistent with theories from other schools, including the marxian profit-squeeze narrative, old-Keynesian cooperatist, as well as neo-classical results and lays the fundament for the post-Kaleckian strand of literature.

Dissatisfied with the medium or long-term approach of many post-Keynesian theories at the time, which were, in the opinion of the authors, unable to explain the business cycle (Taylor et al., 2006), Barbosa-Filho and Taylor (Barbosa-Filho & Taylor, 2006) integrate the above mentioned (Marxian) Goodwinian predator-prey narrative into a demand-led framework as a *"dynamic version of the Dutt–Rowthorn model. It basically replaces Goodwin's saving-determined investment with output determination by effective demand, and his Phillips' curve with a distributive relationship"* (Taylor et al., 2006). Ignoring the critique raised by Bhaduri and Marglin on using the simple rate of profit (instead of its share in output) together with capacity utilization in the investment function, the Neo-Goodwinian (and in spirit neo-Kaleckian) model produces, under certain assumptions, Goodwin-type counter-clockwise (or anti Goodwin-type clockwise (Kiefer & Rada, 2015)) movements in the capacity utilization – wage-share – space by interacting effective demand- and distribution- curves. Thereby, the model is theoretically able to generate profit- as well as wage-led demand regimes and distributive dynamics characterized as profit- and wage-squeeze. While the original authors claim that long-term growth depends on the interactions of both curves over the cycles, this is criticized for a variety of reason discussed below (Blecker, 2016; Lavoie & Nah, 2020; Stockhammer, 2017).

2.1.2. Empirical

The Post-Kaleckian and Neo-Goodwinian models have spurred a vast number of empirical investigations to determine distributive, and especially demand regimes. While the majority of empirical studies have used one of two econometrical methodological lines ("aggregative" or "structural"), although some mixtures exist. More recently experiments with alternative methods were conducted. This section gives a brief overview over the methods and presents the obtained results with a focus on Germany (where available). The categorization is adapted from (Blecker & Setterfield, 2019) but alternatives exists (Stockhammer, 2017).

The "structural" (or behavioural equations) approach estimates the different components of demand independently from each other and derive the cumulated effect of consumption, investment, exports, imports and the price level by summing up the partial derivates of aggregate demand (Blecker & Setterfield, 2019, p. 237).

Bowles and Boyer are amongst the first to test the neo-Kaleckian models empirically and find Germany to be slightly profit led (Bowles, 1995). Harvie tests for Goodwin-cycles (in its original form) and finds support of their existence, suggesting profit-squeeze in the USA (Harvie, 2000). Naastepad and Storm analyse demand regimes in OECD countries between 1960-2000 and find Germany s aggregate demand to be wage-led (Naastepad & Storm, 2007). Hein and Vogel extend the time-frame by 5 years (1960-2005) and find aggregate demand to be wage-led for Germany considering also effects of international trade (Hein & Vogel, 2008). Stockhammer, Hein and Grafl investigate the effect of globalization and wage-moderation in Germany analysing annual data between 1970 and 2005 and find that the various effects of globalization (like increased international competition , capital mobility and trade) are partially offsetting each other and are not sufficient to change the demand-regime of Germany, as a large open economy, from its wage-led position (Stockhammer et al., 2011). Stockhammer, Rabinovitch and Reddy take a historical perspective and analyse data from 1870 to 2010 and find the demand regime of Germany overall to be wage-led (Stockhammer et al., 2021).

The "aggregative" (or "reduced form") approach estimates the effects of the wage-share, or any control variable, on economic activity (usually proxied by capacity utilization) directly (Blecker & Setterfield, 2019, p. 237). This systemic approach is often utilizing variants of the Vector Autoregression Model (VAR) which runs regressions of lagged dependent variables on the dependent to obtain impulse response functions and analyse the statistical effects of shocks in one variable onto the others.

Goldstein pioneered this approach in his investigation of Goodwin-patterns in the US-economy (Goldstein, 1999), for which he found support. Barbosa-Filho and Taylor, who integrated the Goodwin narrative in the neo-Kaleckian demand-led framework (see above) use this approach to substantiate their theory empirically by analysing US data between 1948-2002 by a VAR-model including lags and excluding contemporaneous effects. In line with their theory, they find profit-led demand regimes and a profit-squeeze for the USA (Barbosa-Filho & Taylor, 2006). Kiefer and Rada find in their aggregative VAR study of OECD countries, including Germany, between 1971 and 2012 profit-led demand-regimes and show a wage-squeeze distributive dynamic. Although the basic Goodwin model is widely regarded as performing poorly on real life-data (Flaschel, 2010), Konstantakis (Konstantakis et al., 2014) claim to have found support for the existence of Goodwin-type patterns in Germany, using an alternative econometrical method.

Stockhammer, Onara (and after them others) used the VAR methodology to estimate behavioural equations and are included in this part of the review to show that some flexibility regarding the use of the methodologies exists. While Stockhammer and Onara are limited by data for Germany due to the reunification, they find for the UK, USA and France that employment is wage-led, while income distribution has little effect on demand or distribution (Stockhammer & Onaran, 2004). Stockhammer and Stehrer investigate explicitly short-term effects comparing neo-goodwinian theory with post-Kaleckian ideas by separate VAR estimates of investment and consumption demand and find a wage-led aggregate demand regime for Germany using quarterly data from 1970:1 to 2007:2 (with chained data for west-Germany before the 'reunification') (Stockhammer & Stehrer, 2011). Following Stockhammers (Stockhammer, 2017) advices on estimation design and control variables to avoid omitted variable bias, Covi finds, when comparing demand regimes of two areas of the EU (surplus vs. deficit countries), that northern surplus regions (including Germany) are profit-led, while southern regions are wage-led (Covi, 2018).

Other, more recent empirical strategies include reduced-form estimates (López et al., 2011), autoregressive distributed lag models (ADRL) (Araujo et al., 2019; Araujo & Moreira, 2021) , stochastic differential approach (McIsaac, 2021) and neural networks (Barrales-Ruiz & Arnim, 2021).

Interestingly, the two theoretical approaches discussed above (Keynesian/Kaleckian-narrative vs. Classical/Goodwinian narrative) find largely support for their respective theories and estimates on similar data yield different results (Blecker & Setterfield, 2019, p. 241). According to mainly Post-Kaleckian authors this is due to methodological shortcomings of the single equation aggregative approach (Blecker & Setterfield, 2019, pp. 245–250; Stockhammer, 2017):

First, by estimating aggregated effects of demand on distribution, and vice versa, the information-value of the underlying theory is limited as omitted variables, e.g. international trade (Arnim et al., 2012), financial variables (autonomous consumption) (Dutt, 2006, 2019; Fiebiger, 2018), and personal income distribution (Carvalho & Rezai, 2016) might bias the estimation.

Second, the proxy of economic activity is either employment (in the old Goodwin-model), which is known to be persistent in many European industrial economies and as such relatively inelastic to changes in economic activity, or capacity utilization/output gap, which itself is often only statistically derived by filtering the data in trend and cycle components using an Hodrick-Prescott-(HP-)filter (Hodrick & Prescott, 1981) This is questionable as the HP-Filter is known to bias both ends of the time frame in question (Hamilton, 2018). Additionally, it has no real fundament in economic activity (this matter will be discussed in the empirical section below) and might bias the estimation to find profit-led results (Blecker, 2016).

Third, more recently it is argued that labour productivity is not only determined by the rate of technical change, but fluctuating over the cycle due to the existence of (fixed) overhead labour (Lavoie, 2009a; Lavoie & Nah, 2020). This, as well as the next note will be discussed in the subsequent section.

Another point raised by the literature is that the different findings might be due to alternative views on the relevant scope of analysis. While Neo-Goodwinians, in the Marxian structuralist tradition, focus on short-term cyclical effects, Post-Kaleckian focus un medium-term growth (trend) determinants (Blecker, 2016) and lack(ed) a conclusive theory of the cycle (Stockhammer, 2017; Stockhammer & Stehrer, 2011; Taylor et al., 2006), rendering the different results to a misunderstanding of the schools between each other. Especially Blecker (Blecker, 2016) argues for the possibility to find profit-led and wage-led demand regimes for the same country dependent on circumstances of redistribution and the time-frame in consideration, as cost-effects of rising wages influence investment demand faster, than income effects consumption. Stockhammer and Stehrer (Stockhammer & Stehrer, 2011) have also shown that the findings are sensitive to the number of lags chosen. Others, rather classically inspired authors, however, claim Goodwin-type cycles to be a rather long-term feature of the economy (Chiarella et al., 2009; Flaschel & Groh, 1993).

2.2. Within Distribution of Wages

The distribution of wages (personal wage income distribution), or within distribution of the wage-share, has received rising attention from economist in orthodox and heterodox schools alike, as wage-differentials increase (Piketty & Goldhammer, 2018; Wang, 2020). While neoclassical economists focus on the increasing returns to skill, for example due to technical change and increased international competition (Juhn et al., 1993), heterodox, especially Marxian and post-Keynesian authors focus on the increasing proportion of unproductive labour in the wage-share (Mohun, 2014), the distribution between managers and direct employees (Palley, 2017; Tavani & Vasudevan, 2014) and overhead labour (Lavoie, 2009a), which is concept somewhat related to both of the former.

2.2.1. Theoretical

Two effects of the within distribution of wages are relevant for this inquiry in demand regimes and distributive dynamics. Frist, we can assume that propensities to consume and to save differ not only between capitalists and workers but also between workers with different magnitudes of wage income. These demand effects will likely have an influence on the demand schedule (Carvalho & Rezai, 2016; Palley, 2017; Tavani & Vasudevan, 2014). Secondly, when considering overhead-labour a number of authors have argued that overhead-wages are experienced by capitalists as fixed costs and the elasticity of overhead-employment to profits is lower than for direct labour. Capitalists “hoarding” supervisors over the slump of the cycle results in procyclical labour productivity when the composition of labour changes towards direct labour (Kalecki, 1971; Kurz, 1991; Lavoie, 2009a, 2014, pp. 323–325; Lavoie & Nah, 2020). This would influence the distribution schedule and the investment decision.

Concerned with within-wage inequality and aggregate demand were Tavani and Vasudevan (Tavani & Vasudevan, 2014) following a Neo-Kaleckian framework in classical (Marxian) tradition. Their three-class model (capitalists, managers, workers) produces "*two distinct regimes with respect to the responsiveness of investment demand to profitability: a low investment–response regime, where effective demand appears to be both wage–led and inequality–led; and a high investment–response regime, where demand looks profit–led*" (Tavani & Vasudevan, 2014). Both regimes imply a negative response of capacity utilization to a more equal income distribution by redistribution towards non-managers(/supervisors). This highlights the shared interest of capitalists and managers for a more unequal income distribution and high rates of profit.

Palley (Palley, 2017) on the other hand uses a rather post-Kaleckian framework for his analytical three-class model of distribution and demand. He incorporates, different from (Tavani & Vasudevan, 2014) a Keynesian consumption demand multiplier and argues that a more equal distribution of wages would always increase capacity utilization, regardless of the overall demand-regime, as the propensity to consume is higher for non-supervisory workers, than supervisors. Hence, redistribution towards non-supervisory workers could increase capacity utilization through the consumption channel, without diminishing profitability and as such investment demand.

Kalecki, while defining the "overhead" in Marxian tradition as those workers earning salaries and rather concerned with the 'realization' of profits (by organizing and controlling the labour process) and direct-labourers as wage-earners and surplus-value producers, stresses the importance of their distinction as of "*considerable interest*" (Kalecki, 1971, p. 75) to understand the business cycle. He shows that a wage-share combining wages and salaries is less fluctuant than the gross income of the private sector. On similar lines Kurz notes: "*While manual workers are employed in proportion to the level of production, overhead workers are employed in proportion to the capital stock in existence*" (Kurz, 1991). This notion contrasts with the theoretical assumptions introduced in the previous paragraphs, which limit the differentiation of the wage-share to saving and demand effects and assume a constant proportion of overhead labour to output. The importance of this counter- (or un)-cyclicality was not only stressed by Weisskopf (Weisskopf, 1979) for a refined Marxian theory of the cycle, but especially concerning the relationship of distribution and growth as well as the impact of technical change by neo- and post-Kaleckian authors (Hein, 2014; Kurz, 1991; Lavoie, 1992, 1995, 2014; Rowthorne, 1981).

Consequently, incorporating the Sraffian-inspired strain of literature regarding super multipliers (Freitas & Serrano, 2015; Serrano & Freitas, 2017) of (semi-) autonomous demand components (Fiebiger, 2018; Fiebiger & Lavoie, 2019) and addressing the critique of Harrodian instability (Blecker & Setterfield, 2019, pp. 281–313; Hein, 2014, pp. 441–467) of an endogenized desired rate of capacity utilization to stay consistent with post-Kaleckian theories for long run growth (Allain, 2015), Lavoie and Nah (Lavoie & Nah, 2020) developed a theory of the business cycle highly reliant on the cyclical productivity effects induced by the existence of overhead labour.

In their two-class closed economy model, excluding a government and with monopolistic firms setting prices by a mark-up on unit-costs, one part of households owns shares of the firms and provide overhead/supervisory services to firms, the other offers direct labour services and consume all their income. Supervisory labour receives a wage-premium compared to direct labour. Prices are set such that a target rate of profit is achieved when the economy runs at a target rate of capacity utilization. Under this condition, as the cost for overhead labour and the target rate of profit does not depend on the realized output but the target rate of capacity utilization, an increase in the target rate of profits or the wage premium for supervisory labour forces an increase in the mark-up. Consequently, the share of income going to direct labour in real terms will decrease, when the proportion of supervisors, their wage-premium or the target rate of profits increases.

In opposition to the models introduced earlier, especially the neo-Goodwinian, the share of profits becomes a positive function of capacity utilization. The relative proportion of supervisory in total labour is ought to decrease, as is the respective supervisory-wage-share. This formulation suggests a contemporaneous effect of capacity utilization on the profit-share, which is captured in the alternative orderings of causation specified in the empirical section below (Table 1). Understanding the demand effects of a permanent increase in the wage-premium of supervisory workers is not trivial, as two conflicting effects occur: On the one hand, a redistribution of retained earnings to supervisors increases aggregate consumption, as managers consume, which firms do not. On the other hand, the redistribution from direct labour to supervisory labour decreases aggregate demand, as the propensity to consume of direct labour is higher (unity) than supervisory labour. Hence, the overall effect of a larger wage-difference between direct and supervisory labour depends on the retention ratio of the firm, supervisors' propensity to consume and the distance of capacity utilization to its target rate. Combining demand and supply side equations for the short-run, the model generates demand-led aggregate demand "*in the sense that an autonomous increase in the costing margin of firms calculated at the normal rate of capacity utilization, i.e., an autonomous increase in the mark-up, leads to a fall in the rate of utilization*" (Lavoie & Nah, 2020) which will in general be accompanied by a rise in the profit-share, but not always, which might lead to a false identification as profit-led demand in empirical investigations. While the overall effect of a redistribution from supervisory to direct wage share is uncertain, it is more likely to decrease the profit-share, than to increase it.

Arguably, both (demand and distributive) effects of the existence of overhead labour have the potential to bias the estimation of the demand regime to find profit-led results.

2.2.2. Empirical

The seminal empirical works on unproductive and, deducible from that, overhead labour is Simon Mohun (Mohun, 2005, 2006, 2014). He, together with Roberto Veneziani is, to my knowledge, also the first to integrate the variable of supervisory labour in the estimation of the business cycle following the traditional Goodwin model (Mohun & Veneziani, 2008).

Carvalho and Rezai theorize the "saving rate to be an increasing function of wage inequality" (Carvalho & Rezai, 2016) and follow the neo-Goodwinian theory (Barbosa-Filho & Taylor, 2006) in their empirical determination of demand regimes. Estimating a two-dimensional threshold VAR (TVAR) for annual US data between 1967 and 2010, they find the Neo-Goodwinian profit-led results are largely due to rising wage inequalities after 1988 and obtain weaker profit-led result for periods with lower inequality in the income distribution, supporting their theoretical considerations.

Michael Cauvel (Cauvel, 2019) investigates the procyclical productivity hypothesis raised by Lavoie (Lavoie, 2014, pp. 323–325, 2017) in contrast to the neo-Goodwinian model. Estimating impulse response functions from (S)VAR models for quarterly US data between 1952 and 2016 he finds the profit-led results to be biased when not accounting for procyclical productivity effects of labour or outlaw contemporaneous effects of the variables. Including these effects he finds a wage-led aggregate demand and wage- as well as profit-squeeze in regard to distribution.

Another empirical approach is investigated by Lilian Nogueira Rolim (Nogueira Rolim, 2019) by directly disaggregating the wage-share in a supervisory-wage-share and a direct-wage-share using US data from Simon Mohun (Mohun, 2014). She conducts Structural Vector Autoregression (SVAR) estimates utilizing annual data from 1967 to 2010 in the USA and compares the obtained aggregated impulse response functions (AIRFs) of an aggregated baseline model similar to the neo-Goodwinian one (Barbosa-Filho & Taylor, 2006) to an alternative model including two distinct wage-share variables (direct and supervisory). Nogueira Rolim still finds an overall profit-led demand regime in the disaggregated estimate but finds evidence in the disaggregated data for a positive effect of redistribution towards the direct wage-share on capacity utilization. Regarding the distributive curve, she presents weak support for the countercyclicality of the supervisory-wage-share.

3. Empirical Strategy and Methodology

Following the arguments developed in the preceding literature review, this thesis will expand our knowledge about the business cycle considering the existence of overhead labour for German data. Two interlinked hypotheses are put forward:

First, Profit-led results arise as the wage-share is not disaggregated (Lavoie, 2009b; Palley, 2017).

Second, coarseness and length of data frame plays a role whether the economy is classified as wage-led or profit-led (Blecker, 2016).

To investigate our first hypothesis, the base line model, following broadly neo-Goodwinian (Barbosa-Filho & Taylor, 2006) lines, is compared with an alternative model which decomposes the wage-share in a supervisory-wage-share (overhead labour) and a direct-wage-share (direct labour) following Nogueira Rolims strategy (Nogueira Rolim, 2019). Both models will be estimated using a systemic approach utilizing Structural Vector Autoregression Model (SVAR) and analyse the obtained Aggregated Impulse Response Functions (AIRFs) to understand how the variables react over time to unit-shocks in one of the variables.

Following (Barbosa-Filho & Taylor, 2006; Carvalho & Rezai, 2016; Cauvel, 2019) we estimate a VAR of the following form:

$$y_t = \mu + \sum_{j=1}^{L} F_j y_{t-j} + e_t$$

Where y_t is a vector of dependent variables we will specify below, t is the time-period, μ is the constant, F_j represents the coefficient matrices to be estimated e_t the error term, L is the number of lags, which are indexed as time period by j = 1, …, L.

The vector of dependent variables is specified as the first differences of the natural-log values of capacity utilization (u) and the wage-share for the bivariate baseline model:

$y_t = [\Delta \ln(cu_t), \Delta \ln(ws_t)]$.

For the alternative model the wage share is disaggregates such that we arrive at a multivariate VAR-model with the first differences in the natural log values of capacity utilization (cu), the direct-wage-share (dws) and the supervisory-wage-share (sws) as endogenous variables:

$y_t = [\Delta \ln(cu_t), \Delta \ln(dws_t), \Delta \ln(sws_t)]$.

The first differences of the log values are taken to avoid unit-root-processes and achieve stationarity of all variables, which is a precondition for VAR estimation. The respective tests will be shown below (Table 2, Table 7).

As we are interested in not only correlations but investigate the causal relationship of the endogenous variables in the system, we must impose restrictions on the contemporaneous effects of variables onto each other. These ‘structural restrictions’ are an option to resolve the identification problem of macroeconomic systems in which ‘everything influences everything’. It is a precondition to obtain uncorrelated errors of the endogenous variables and be able to conduct meaningful AIRFs. This thesis will use Cholesky decompositions or ‘triangularization’, first introduced by Christopher Sims in 1980 (Sims, 1980). Following this method, variables have only contemporaneous effects on variables that come after them (further to the right) in the ordering. The Cholesky ordering follows economic theory, although we will see statistical test for their plausibility later. According to the previous literature review, we can contrast the neo-Goodwinian causal reasoning with the post-Kaleckian. Although the original model of Barbosa-Filho and Taylor excluded any contemporaneous effects (Barbosa-Filho & Taylor, 2006), successors have improved on this deficiency. I will follow their (Carvalho & Rezai, 2016; Cauvel, 2019; Nogueira Rolim, 2019) specification and define the Goodwinian baseline causation as: Wage-share causes capacity utilization, while following the Post-Kaleckian reasoning capacity utilization contemporaneously affects the profit share. Extensions for the disaggregated alternative model can be found in Table 1. In this thesis the baseline Goodwinian ordering is tested for its sensitivity to theoretical assumptions by an alternative ordering of the Post-Kaleckian form (Lavoie & Nah, 2020).

Table 1: Cholesky Orderings (Contemporaneous effects on all variables to the right)

	Neo-Goodwinian (G)	**Post-Kaleckian (K)**
Baseline:	$\Delta\ln(\mathrm{WS}) \rightarrow \Delta\ln(CU)$	$\Delta\ln(CU) \rightarrow \Delta\ln(WS)$
Alternative:	$\Delta\ln(DWS) \rightarrow \Delta\ln(CU) \rightarrow \Delta\ln(SWS)$	$\Delta\ln(CU) \rightarrow \Delta\ln(SWS) \rightarrow \Delta\ln(DWS)$

As all variables are treated endogenously, our aggregate approach estimates the demand schedule simultaneously with the distribution schedule. I follow broadly Nogueira Rolim (Nogueira Rolim, 2019) when determining the expected signs of demand and distribution schedules. Based on the Post-Kaleckian model of Bahduri and Marglin (Bhaduri & Marglin, 1990) aggregate demand depends (in the closed economy case) on the reactions of the two demand components (S for savings and I for investment) to changes in the share of profits (π) and capacity utilization (cu).

$$\frac{dcu}{d\pi} = \frac{I_\pi - S_\pi}{S_{cu} - I_{cu}}$$

Assuming the Keynesian stability ($S_u - I_u > 0$) to hold, aggregate demand will be categorized as "wage-led" when a growth in the wage share (decrease of the profit share) overcompensates the negative impact of falling profitability on investment such that:

$$\frac{dcu}{d\pi} < 0$$

Conversely, we will characterize aggregate demand as “profit-led”, and expect investment demand to react stronger to a decrease in profitability than consumption demand, when:

$$\frac{dcu}{d\pi} > 0$$

Including our reasoning developed in the literature review on the personal distribution of wages, increases in the direct-wage-share have likely positive effects on consumption demand due to the higher propensity to consume of those with comparatively lower incomes, as suggested by Palley as well as Carvalho and Rezai (Carvalho & Rezai, 2016; Palley, 2017) rendering wage-led results more likely in a case where an increase in the wage-share stems from an improvement of the position of direct labour compared to one in which overhead-wages dominate the redistribution.

Regarding the distributive relationship a profit squeeze is theorized and was empirically suggested by Barbosa-Filho and Taylor as well as Carvalho and Rezai (Barbosa-Filho & Taylor, 2006; Carvalho & Rezai, 2016) assuming wage-bargaining effects of workers with increasing economic activity (proxied by cu). Lavoie and Nah (Lavoie & Nah, 2020) have provided another explanation for this observation. Under certain conditions a negative response of the profit-share to an increase in capacity utilization might occur due to increases on the target rate of profits, changes in the propensity to safe of supervisors or the wage-premium of overhead labour. In terms of derivatives:

$$\frac{d\pi}{dcu} < 0.$$

The alternative distributive schedule found in the literature is the wage-squeeze which is characterized by decreasing wage-share when capacity utilization increases. This can not only be explained through structural effects of wage-bargaining (wages grow lower than productivity over the whole cycle) but also through the existence of an overhead labour wage premium as a fixed cost for capitalists, as suggested by Lavoie (Lavoie, 2017; Lavoie & Nah, 2020) the profit-share can be understood as pro-cyclical. In terms of derivatives:

$$\frac{d\pi}{dcu} > 0.$$

To test our second hypothesis, the analysis described above is conducted for two datasets, which will be described in more detail in the dedicated sections below. Both datasets are limited to the Federal Republic of Germany but have different time scales and periodicities. The first includes quarterly data from 2007 Q1 to 2021 Q4 and include a high-quality proxy for supervisory labour in Germany. The second dataset includes annual data from 1991 to 2017 and proxies the supervisory wage as the share of top 10% of wage-earners in the total wage-sum, which roughly corresponds to the proportion of supervisors in the labour force between 2007 and 2021, who also had the highest average income in the sample. The obtained AIRFs will be compared, as well as their respective sensitivity to alternative Cholesky-orderings investigated.

3.1. Short-Term: 2007 Q1 – 2021 Q4

3.1.1. Data

For the forthcoming estimate, data on four variables are needed: First, the aggregated wage-share, second the supervisory-wage-share, third, the direct-wage-share and fourth, capacity utilization.

First, to obtain the wage-share I use the national accounts of the Federal Republic of Germany ("Volkswirtschaftliche Gesamtrechnung des Bundes") which is available in quarterly and annual periodicity after 1991 online through the Genesis-database of the German Federal Statistical Office (in the following referred to as "Destatis"). To derive a proxy of the wage-share, total employee compensation is divided by gross value added. Seasonally adjusted values are taken. Hence,

$$WS := \frac{Employee\ Compensation}{Gross\ Value\ Added}.$$

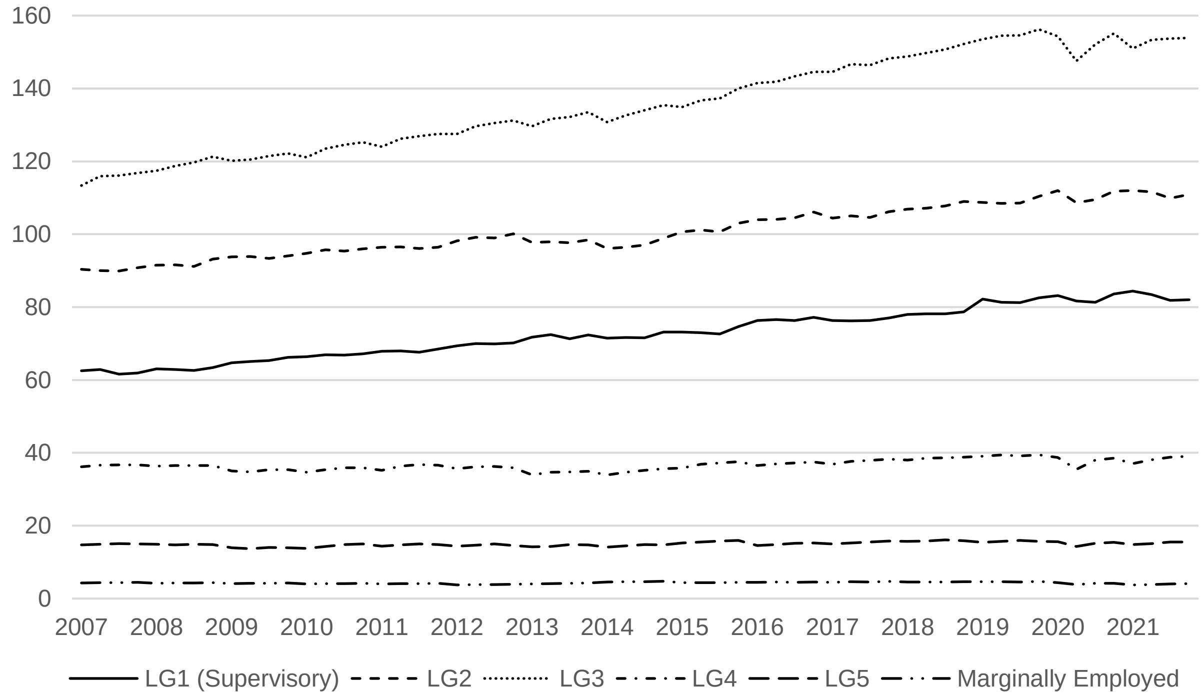
As Mohun and Veneziani (Mohun & Veneziani, 2008) discuss, this approach is likely overstating the profit-share as the compensation of self-employed as well as income from rents are included in the share of profits. Additional bias is added, as employee compensation also includes wages paid to state-employees, which should not be subject to cyclical movements, and employees in the farming-sector, which will likely underly different dynamics which are not included in the theoretical considerations of the models under investigation.

Second, to disaggregate the wage-share, a measure of the supervisory-wage-share is needed. The Federal Republic of Germany and its predecessor states are collecting data on work-time since 1927 (Sensch, 2015). After the end of the second world-war the monitoring of worktime and wages was systematized, and quarterly earnings-surveys conducted at least since the 1950s. But only after the reform of the underlying law in 2007 the survey was extended to employees outside of industry and mining and differentiated all wage-earners in 5(/6) performance groups and by gender, thereby allowing a much better view on the wage-structure. The survey builds the bases for the computation of employee compensation in national accounting and is therefore highly consistent with our measure of the wage-share. It quarterly surveys 40500 firms with more than 10 employees (for some sectors more than 5) and the response is mandatory by law (Destatis, 2021). The overall quality of the data is very good, although through a change of the sampled population the years 2011 and 2012 are diminished in their comparability. But as aggregated data for the whole economy, not sectoral data, is used, this effect should be acceptable.

Figure 1 presents an overview over the sum of real wages in billions of € in 2015 values. “Performance-groups” (Leistungsgruppen - LG) group together employees with similar tasks, qualifications, and position in the production process. “Marginally employed” are those who work without social protection, a form of work introduced during the liberalization of the labour market (“Agenda 2010”). LG5 groups unskilled workers, LG4 semi-skilled workers and LG3 skilled workers who received vocational training or a university degree. LG4 gathers experienced workers with vocational training or a university degree, some of which have small-scale supervisory authority, like foreman or “Meister”. LG1 gathers all those who have “supervisory and dispositional authority” and will therefore be our proxy for supervisory labour. LG 2 was not included in this proxy, as those low-rank supervisors are rather sensitive to changes in economic activity and often not “hoarded” as theory suggests. Future studies could expand on this notion deriving a less conservative measure of overhead labour.

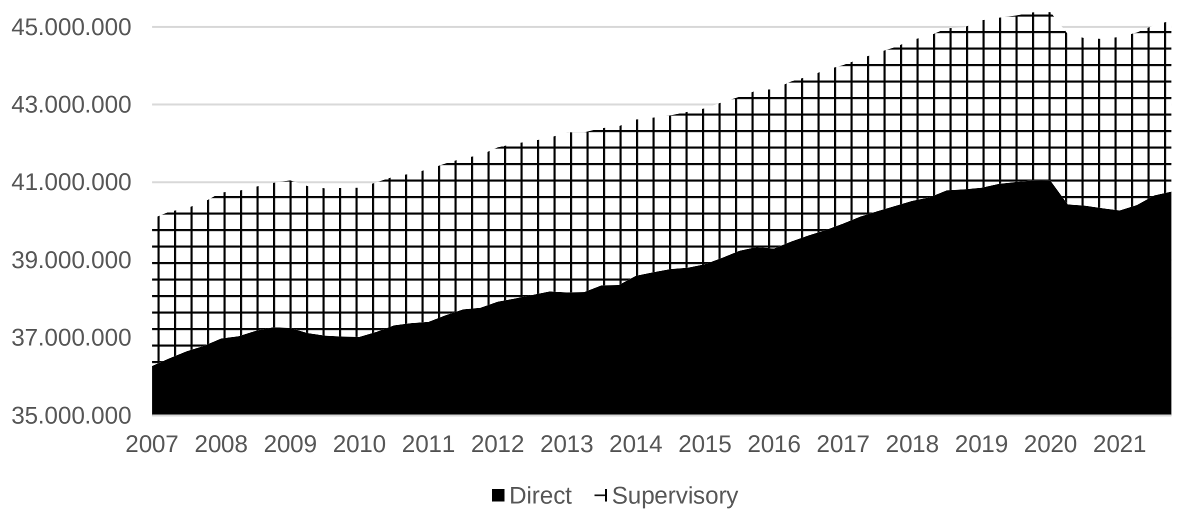
Figure 2 gives an overview over the number of employees over time. While the number of direct labourers grows over the sampled timeframe, it shows sharp declines in times of crises, as happened in 2009 and 2020. The number of supervisors is relatively constant, as theory of overhead-labour suggests.

Figure 1: Quarterly Earnings Survey - Sum of Real Wages in Billions of 2015 €



Data: Destatis 2022a, authors elaboration.
Details: LG1-5 are performance groups, description in text.

Figure 2: Number of Employed Individuals in Germany 2007 Q1 – 2021 Q4 Disaggregated in Supervisory- and Direct-Labour



Data: Destatis 2022a, authors elaboration.
Details: Overhead: LG1, Direct: LG2-5 and marginally employed

The supervisory-wage-share is hence calculated from the sum of wages of LG1 received in the quarter added with annualized special payments to avoid seasonal effects (Christmas and holiday bonuses) divided by the sum of all wages and annualized bonuses, to obtain the fraction of supervisory wages, which is then scaled up to the wage share by multiplication of the factor with the wage-share:

$$SWS := \frac{\sum Wages\ of\ LG1 + \frac{Annual\ Special\ Payments\ of\ LG1}{4}}{\sum All\ Wages\ and\ Special\ Payments} * WS.$$

The bias introduced in the aggregated measure of the wage-share is slightly mitigated in the disaggregated wage-shares, as the wages from the quarterly earnings survey exclude those paid to public employees, such that the dynamic is governed by industry-wages, although the level still includes wages from public-employment.

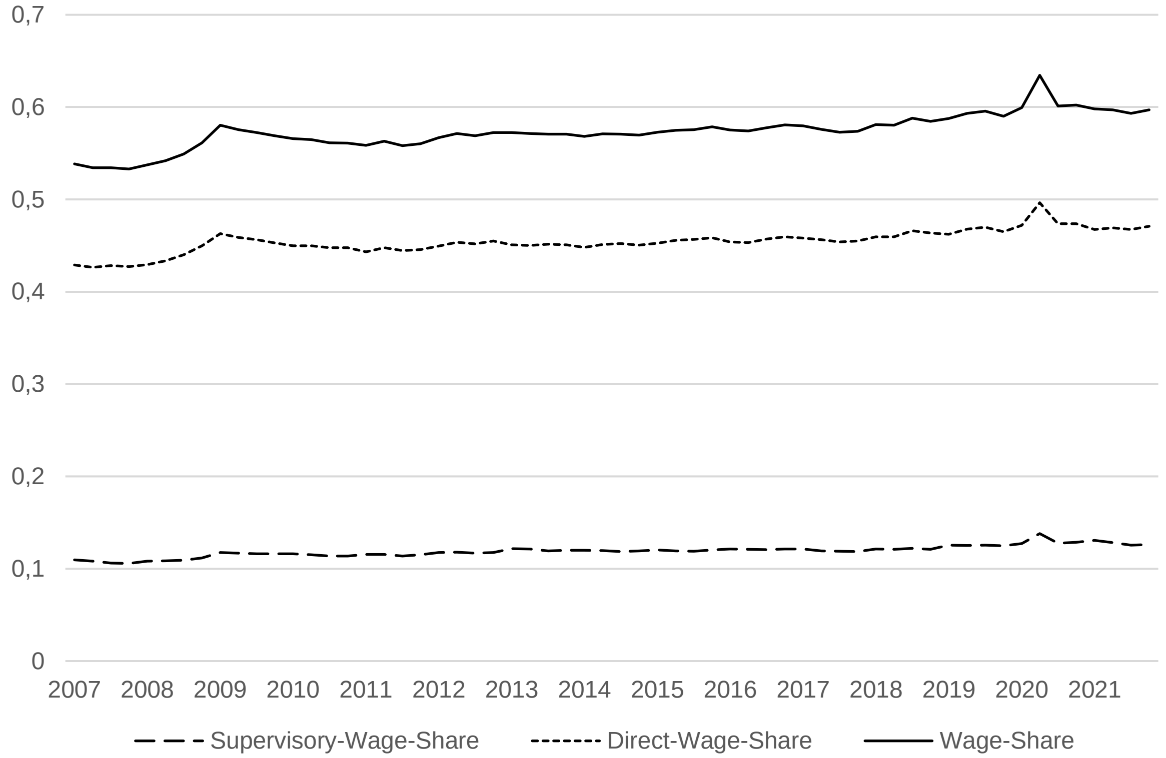
Third, the quarterly direct-wage-share is computed in the same fashion, which corresponds to one minus the supervisory wage-share:

$$DWS := (1 - SWS) * WS =$$

$$\frac{\sum Wages\ of\ \text{LG2} - 5\ \text{and marginal empl.} + \frac{Annual\ Special\ PaymentsLG2 - 5}{4}}{\sum All\ Wages\ and\ Special\ Payments} * WS.$$

The obtained measures of the wage-share and the disaggregated shares is presented in Figure 3. As the years after 2009 were characterized by, compared to the years prior to 2009, relatively good wage-dynamics, the wage-share increases, mainly driven by the direct-wage-share. In times of crises (2009, 2020) the wage-shares show spikes, as employee compensation remains, thanks to the restrictive labour law, relatively stable, as gross value-added plummets.

Figure 3: Wage-Shares in Germany 2007-2021 Quarterly disaggregated in Direct- and Supervisory-Wage-Share



Data: Destatis (2022a; 2022b; 2022c), authors elaboration.

Fourth, a measure for capacity utilization is needed. Capacity Utilization is defined as:

$$cu := \frac{Realized\ Output}{Potential\ Output}$$

Capacity Utilization (taking the fraction of realized output to potential output), sometimes framed as output gap, is subject of vital empirical and theoretical debate. The theoretical debate between Kaleckian and Cassical economists regarding the short-term realized and (long-term) target rate of capacity utilization, its endogenization and interactions in linking short-term cycles and long-term growth (Harrodian critique), is beyond the scope of the paper and can be read elsewhere (Blecker & Setterfield, 2019, pp. 246–249; Lucyna Gornicka & Mr.Jiaqian Chen, 2020; Nikiforos, 2016).

Empirically, at least four approaches exist to estimate potential output and accordingly capacity utilization: Purely statistical, using a production function, estimating the average workweek of capital or through surveys.

The first is of purely statistical nature: Potential output is obtained through decomposing the cyclical and the trend component of GDP by a filtering technique like Hodrick-Prescott- (Hodrick & Prescott, 1981) or Hamilton-Filter (Hamilton, 2018). This is regularly done in analysis of the business cycle, especially with neo-Goodwinian flavour (Barbosa-Filho & Taylor, 2006; Carvalho & Rezai, 2016). This approach is widely criticized. First, the traditionally used HP-Filter skews the output at both ends of the sample (end-sample-bias) and limits the information value (EPC, 2001; Hamilton, 2018). Hamilton has developed an alternative detrending technique which might be superior but is as well subject to the following critiques. Second its values depend on statistical assumptions like the choice of smoothing parameter or 'look-ahead period'. Third, a purely statistical measure has no real-world bases, ignores structural and conventional changes and defines potential output for the next year rather as the world that could have been possible if everything stayed the same from last year. An identification of different components determining potential output cannot be achieved (EPC, 2001). In a Kaleckian understanding, filtered output-series can only be considered to determine short-term capacity utilization as it is constructed as a stationary variable excluding changes in the desired, or normal, rate of capacity utilization or trends (Blecker, 2016; Nikiforos, 2016). As can be seen in Figure 4 both filtering techniques perform relatively similar and identify roughly the crises in 2008/9 and 2020/2021 (at least the HP-Filter). They produce values around a capacity utilization of 100% or over, due to the relatively short sample period and the characteristics of economic performance of Germany.

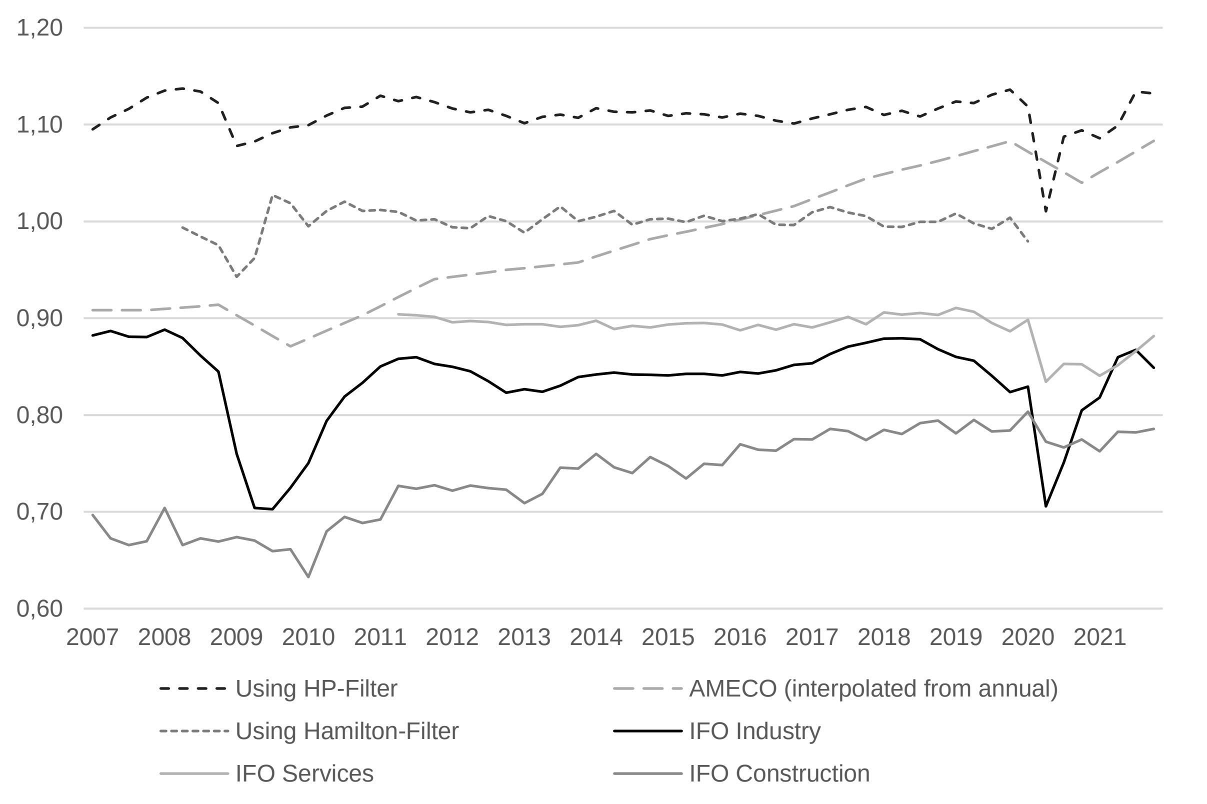
The second approach developed lately, receiving great attention from the economic mainstream, including the institutions of the European Union (EPC, 2001), is the production-function approach. It uses a Cobb-Douglas production function with estimates of total factor productivity and labour supply and deduces potential output by a number of theoretical assumptions and statistical techniques, like a variety of filters (Havik et al., 2014). This technique is the bases for the calculation of potential output of the European commission and builds is the origin of the data found in the AMECO-database. Additional to the critiques raised on the economic theory underlying the estimates, Figure 4 shows, different to the other measures, a clear trend and growth from a reasonable 90% utilization tin 2007 to nearly 110% in 2019 Q4. One might argue that this approach could grasp structural changes of the economy and determine a rather long-term potential output, but neither is this long-term perspective needed for our short-term analysis, nor am I the one to argue so.

Recently Michalis Nikiforos suggested a different approach to estimate long-term capacity utilization and endogenize the long-term desired rate of capacity utilization to the short-term rate. He calculates the average workweek of capital and is here mentioned honourably (Nikiforos, 2016). As we are rather interested in the short-term capacity utilization expressed as the rate of capacity utilization compared to its desired rate, and the computation for Germany is beyond the scope of this paper, it is neither considered for our estimation nor presented in Figure 4.

Lastly, capacity utilization is often measured by simply asking managers of firms. This is the approach of the US-American federal bureau of statistics, as well as common practice in the Federal Republic of Germany, where the IFO-institute is ordered to conduct a business and consumer survey on different indexes of the business cycle. Reliable monthly and quarterly data is available since 1991 for industry and construction, services entered the survey in 2011. The panel sample consists for industry of 3000 units which cover 22% of total employment. The response rate is around 75%. The sample for services 4100 units with a response rate of 57%. For construction the sample consists of 810 units covering 9,4% of total employment and the response rate is 79%. The data was provided directly from the IFO-Institute. All three are represented in Figure 4.

For the preceding estimation, the IFO index of capacity utilization for the industry sector is chosen. The quality of data is good and measures short term rate of utilization as fluctuations around the desired rate of capacity utilization (Nikiforos, 2016). Capacity utilization of the industry sector is chosen, as here demand effects should be most clearly visible, while according to proponents of the autonomous demand theories of the cycle (Fiebiger, 2018; Lavoie & Nah, 2020) other determinants, like the availability of consumer-credit or government expenditure, govern capacity utilization in the construction sector. Including the service-sector might have been interesting, but due to missing data before 2011 this series was excluded from the forthcoming estimation.

Figure 4: Different Measures of Capacity Utilization in Germany 2007-2021 quarterly

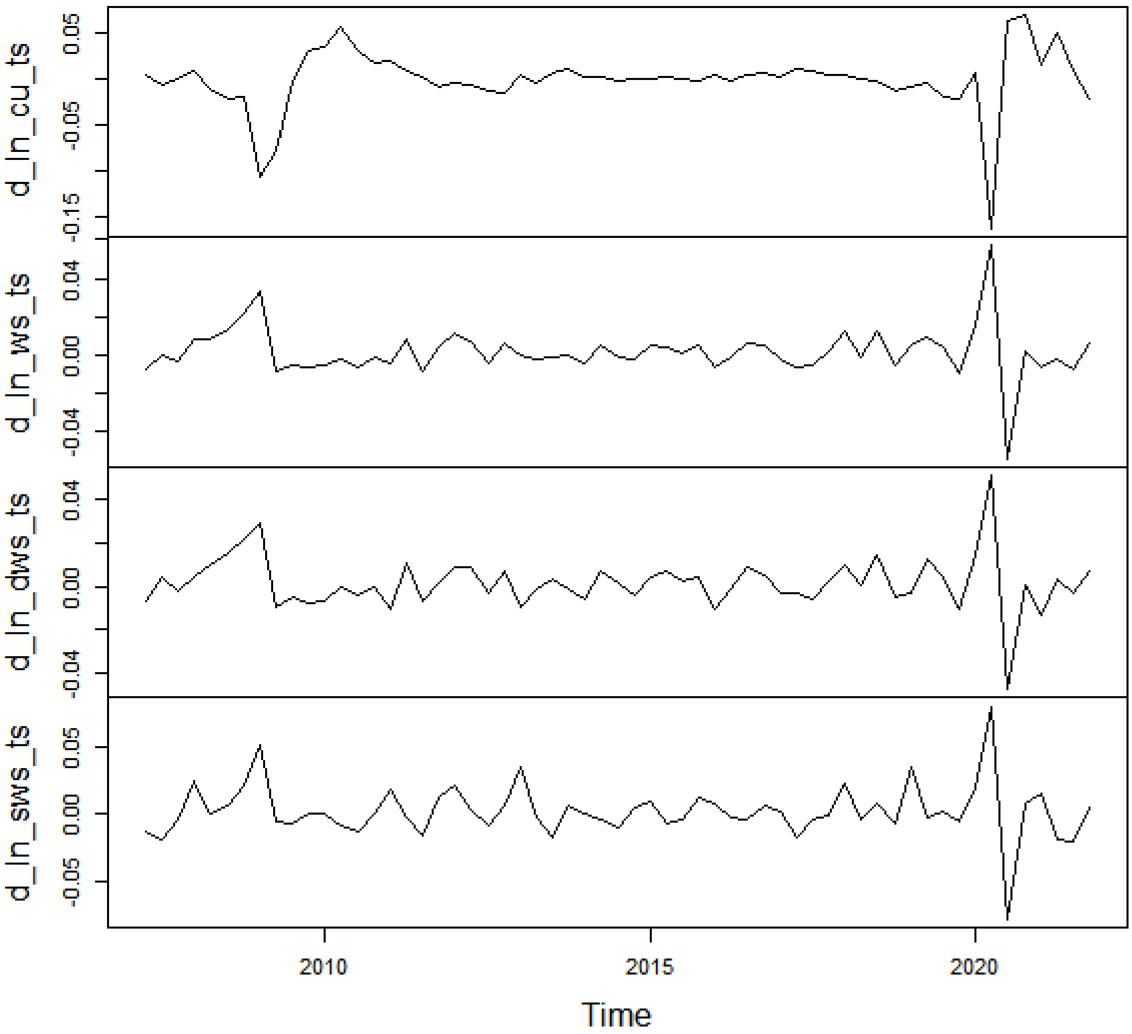


Data: Destatis (2022b), AMECO (2022), IFO (2022), authors elaboration.

3.1.2. Estimation

To conduct our VAR-estimation, the data needs to be prepared to ensure the precondition of stationarity. All data is log-transformed and taken as their first difference to obtain stationarity and results not in levels but percentages of change. This is unproblematic, as we don't decompose our results for different demand components later (Barbosa-Filho & Taylor, 2006; Cauvel, 2019). Differencing the already stationary variable of capacity utilization is not biasing our estimate but increases the internal consistency and simplifies interpretation. After the transformation all conducted tests indicate stationarity (see Table 2 for test-results). All tests, as well as the forthcoming estimations are conducted using "R" as the statistical software, the used packages are referenced in the appendix.

Figure 5: Overview over Transformed Short-Term Data



Data: Destatis (Destatis 2022a; 2022b; 2022c), IFO (2022), authors elaboration.
Details: All data log-transformed and differenced.

Table 2: Tests for Stationarity of Short-Term Data

	Augmented Dickey Fuller test		**Phillips-Perron-Test**		**KPSS-Trend-Test**	
H0:	At least 1 Unit-Root		At least 1 U-R		0 U-R	
Variable:	t-statistic	p-value	t-stat.	p-value	LM-stat.	p-value
D(ln(cu))	-5.6132	0.00	-6.096	0.01	0.097949	0.1
D(ln(ws))	-7.1371	0.00	-9.066	0.01	0.63843	0.01914
D(ln(dws))	-6.8739	0.00	-8.774	0.01	0.62672	0.02021
D(ln(sws))	-3.9838	0.00	-9.775	0.01	0.6385	0.01914

For our baseline model, the optimal length of lags is determined by comparing several tests. The Akaike information criterion (AIC) and Final Prediction Error (FPE) suggests a lag of 4, Hannan Quinn (HQ) and Schwartz (SC) criterion a lag of 1. A lag of 4 is chosen to obtain white-noise residuals. The model output can be seen in Table 12. Tests for Granger causality do not present evidence against (contemporaneous) causations Table 3 in either direction. Hence, the conducted tests do not object the proceeding introduction of structural restrictions.

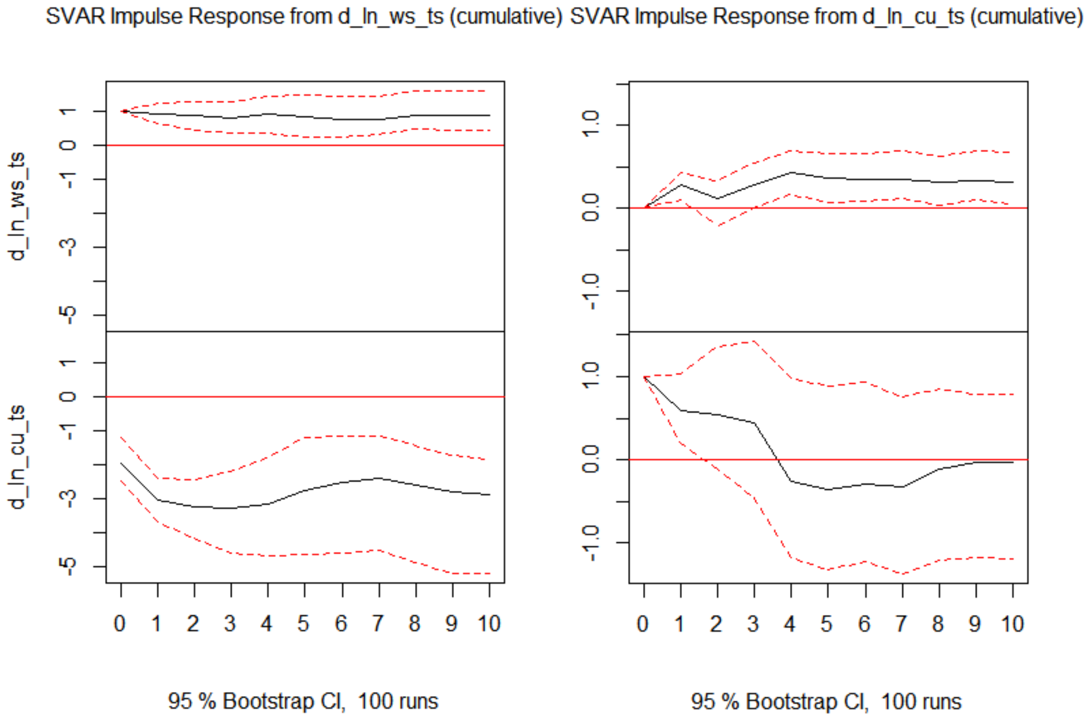
Table 3: Granger Causality Tests for ST-Baseline-Estimate

Null hypothesis	***F-Test***	***df***	***p-value***
D(ln(ws)) does not granger-cause D(ln(cu))	3.6434	4	0.008352
D(ln(cu)) does not granger-cause D(ln(ws))	4.3105	4	0.003024
	Chi-squared	***df***	***p-value***
D(ln(ws)) does not instantaneously granger-cause D(ln(cu))	21.323	1	0.00
D(ln(cu)) does not instantaneously granger-cause D(ln(ws))	21.323	1	0.00

Introducing the structural restrictions in the form of a lower-triangle Cholesky-ordering of the Neo-Goodwinian form (G) yields the A matrix in

Table 13. The obtained AIRFs are presented in Figure 6. The results indicate a profit-led demand regime, as the response of capacity utilization to a positive a one-unit shock in the wage-share is negative (~3%). The distribution schedule is characterized as profit-squeeze, as with a unit shock of capacity utilization, the wage-share reacts positive (>~0.5%). This corresponds to the theoretical expectations of the Goodwinian narrative and will be discussed below.

Figure 6: AIRFs of Baseline ST-Estimate in 'G'-Ordering



The alternative model differentiates the wage-share in direct-wage-share and supervisory-wage-share. The AIC criterion advises a lag of 10, HQ a lag of 3, SC a lag of 1 and FPE a lag of 5. To obtain white-noise residuals, a lag of 5 is chosen. The result of the estimation can be found in

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Table 14. Tests for Granger-causalities (Table 4) provide less evidence for the disaggregated cases, than the baseline estimate. Nonetheless, we can reject all hypotheses that variables would not (instantaneously) cause each other on the 10% level, despite capacity utilization would not cause the wage-shares, which we cannot easily reject. Again, an A-Matrix is estimated to implement the structural restrictions to the VAR (Table 15). The obtained AIRFs are presented in Figure 6.

The AIRF shows a negative response of capacity utilization to a unit-increase in the direct-wage-share. The impact is weaker than in the baseline case. In terms of demand-regimes we can again interpret these results as profit-led demandThe response of capacity utilization to a shock in the supervisory-wage-share is indetermined and fluctuates around the zero with confidence intervals stretching from +2% to roughly -3%.

Looking at the distribution through increased capacity utilization, our AIRF suggests a slightly positive response of both wage-shares to a unit-increase in capacity utilization, indicating a profit-squeeze in our data. The response of the supervisory-wage-share is stronger, than that of the direct-wage-share. In both cases the confidence intervals stretch slightly into negative territory.

Figure 7: AIRFs of Alternative ST-Estimate in 'G'-Ordering

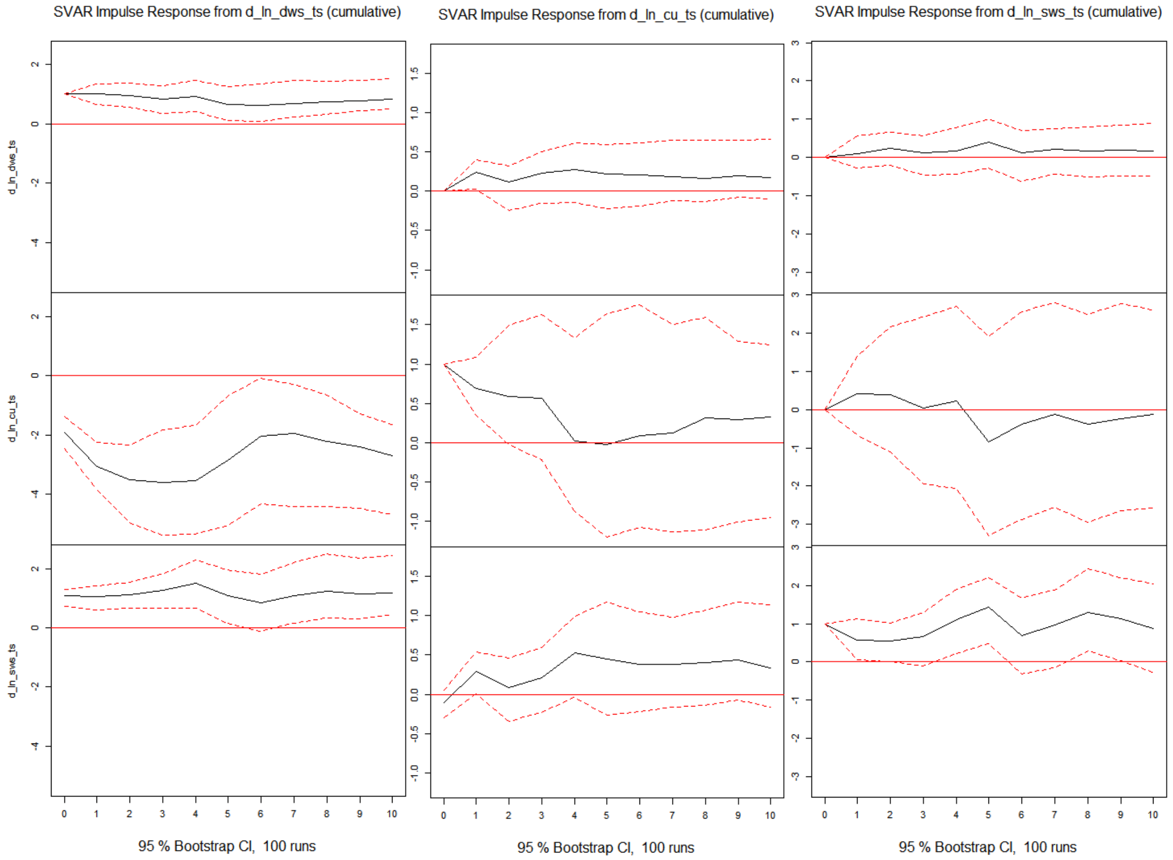


Table 4: Granger Causality Tests for ST-Alternative-Estimate

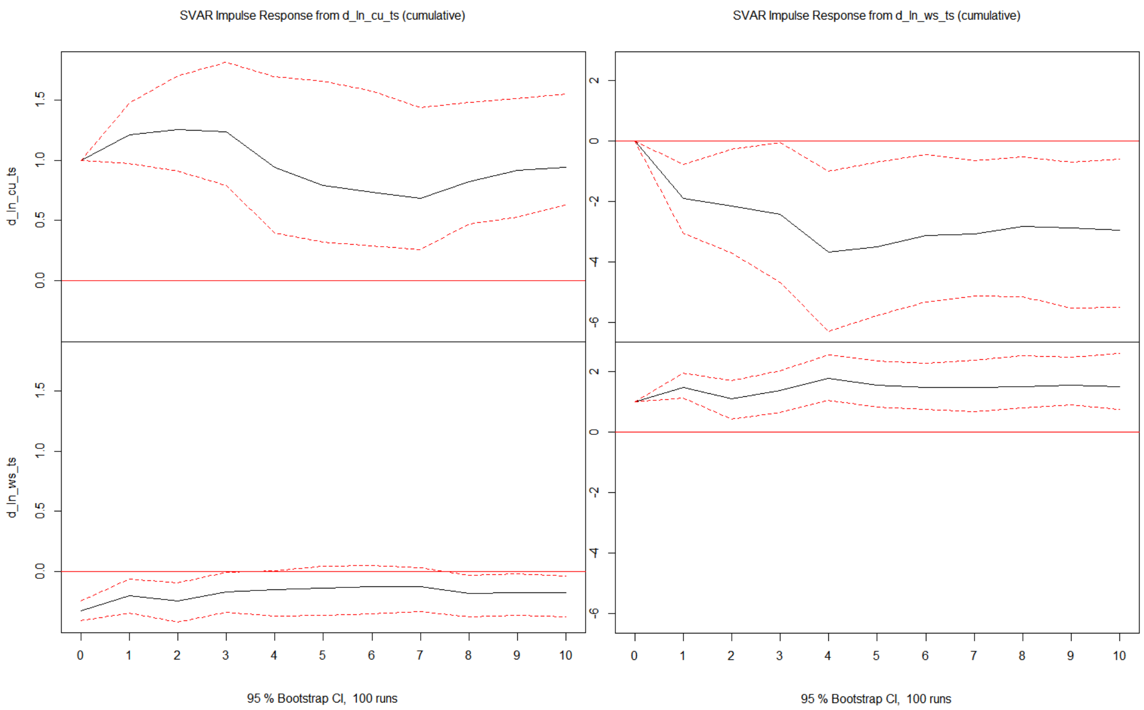
Null hypothesis	***F-Test***	***df***	***p-value***
D(ln(dws)) does not granger-cause D(ln(cu)), D(ln(sws))	1.8195	10	0.06444
D(ln(sws)) does not granger-cause D(ln(sws)), D(ln(cu))	1.8733	10	0.05567
D(ln(cu)) does not granger-cause D(ln(dws)), D(ln(sws))	1.464	10	0.1616
	Chi-squared	***df***	***p-value***
D(ln(dws)) does not instantaneously granger-cause D(ln(cu)), D(ln(sws))	22.671	2	0.0
D(ln(sws)) does not instantaneously granger-cause D(ln(dws)), D(ln(cu))	21.872	2	0.0
D(ln(cu)) does not instantaneously granger-cause D(ln(dws)), D(ln(sws))	21.872	2	0.0

3.1.3 Sensitivity to alternative Cholesky-Ordering

In the following, the sensitivity of the AIRFs is checked by an alternative Cholesky-ordering suggested by the Neo-Kaleckian literature on the business cycle (Fiebiger & Lavoie, 2019; Lavoie & Nah, 2020). Different from Neo-Goodwinians capacity utilization is not solely influenced by distribution, but other factors like credits or exports. Therefore, it is argued that not the direct-wage-share contemporaneously affects the rate of capacity utilization, wich both have effects on the supervisory-wage-share (see Table 1), but the other way around: Capacity Utilization causes the supervisory-wage-share contemporaneously and capacity utilization together with the supervisory-wage-share (with its effect as a fixed cost) influence the direct-wage-share. Certainly there are feedback-effects of the wage-shares on capacity utilization, but these are expected to be relatively small, compared to external and autonomous demand components.

The baseline-model is estimated with lags of 4 following the FPE criterion (see Table 16 for estimation results). Imposing the structural restrictions introduced above, we obtain a A matrix (Table 17) and derive AIRFs (Figure 1). While the response of capacity utilization to a unit-increase of the wage-share is negative, indicating a profit-led regime and is as such consistent with our findings from the previous section, the distributive schedule displays a negative cumulated response of the wage-share to a positive shock in capacity utilization. Different from our findings above, this could be understood as a wage-squeeze distribution schedule, or a pro-cyclical profit-share.

Figure 8: AIRFs of the Baseline ST-Estimate in 'K'-Ordering



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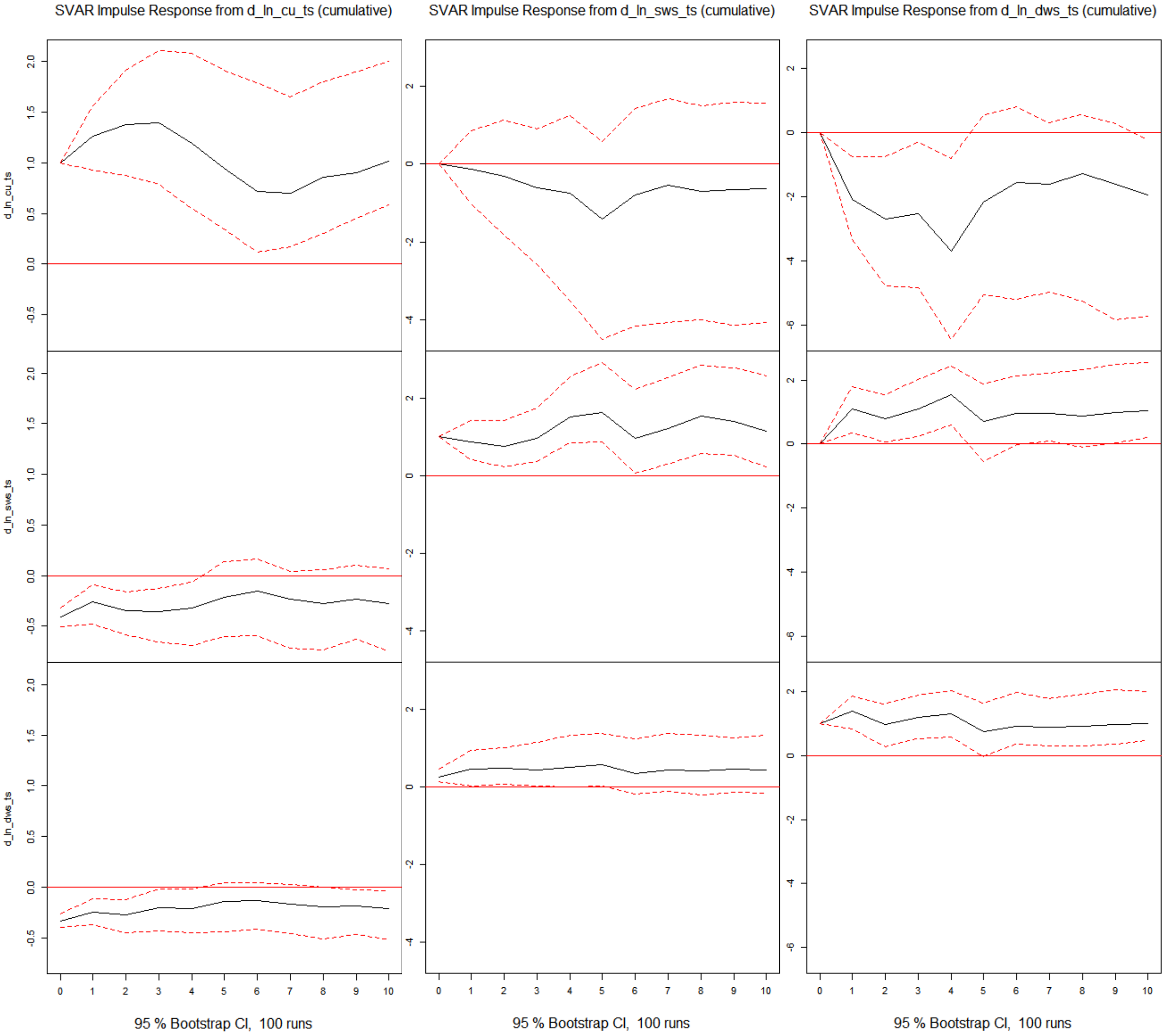
Disaggregating the wage-share again and estimate our alternative model with a lag of 5 (Table 18) and impose structural restrictions (Table 19) we obtain AIRFs presented in Figure 9. A positive unit shock of capacity utilization results in negative responses of both wage-shares. This presents a different distribution schedule than in the G-ordering. While in G-ordering (according to goodwinian rationale) the wage-share increases with rising economic activity through a improved wage-bargaining position, in case of the Kaleckian ordering the data provides evidence for a negative response of both wage-shares to improved economic activity. The stronger response of the supervisory-wage-share (and wider confidence-intervals) could be interpret in favor of the Post-Kaleckian argumentation of a countercyclical supervisory-wage-share. In terms of demand, a unit shock in the direct-wage-share leads to a negative cumulated response of capacity utilization of ~2% after 10 quarters. The response of capacity utilization is stronger to a shock of the direct-wage-share, than to a shock of the supervisory-wage-share. Both confidence intervals strech in the positive realm, and especially the supervisory-wage-share appears undetermined, giving rise to the argued short-term cost effect of direct-wages.

Figure 9: AIRFs of the Alternative ST-Estimate in 'K'-Ordering



3.1.4. Discussion of Results

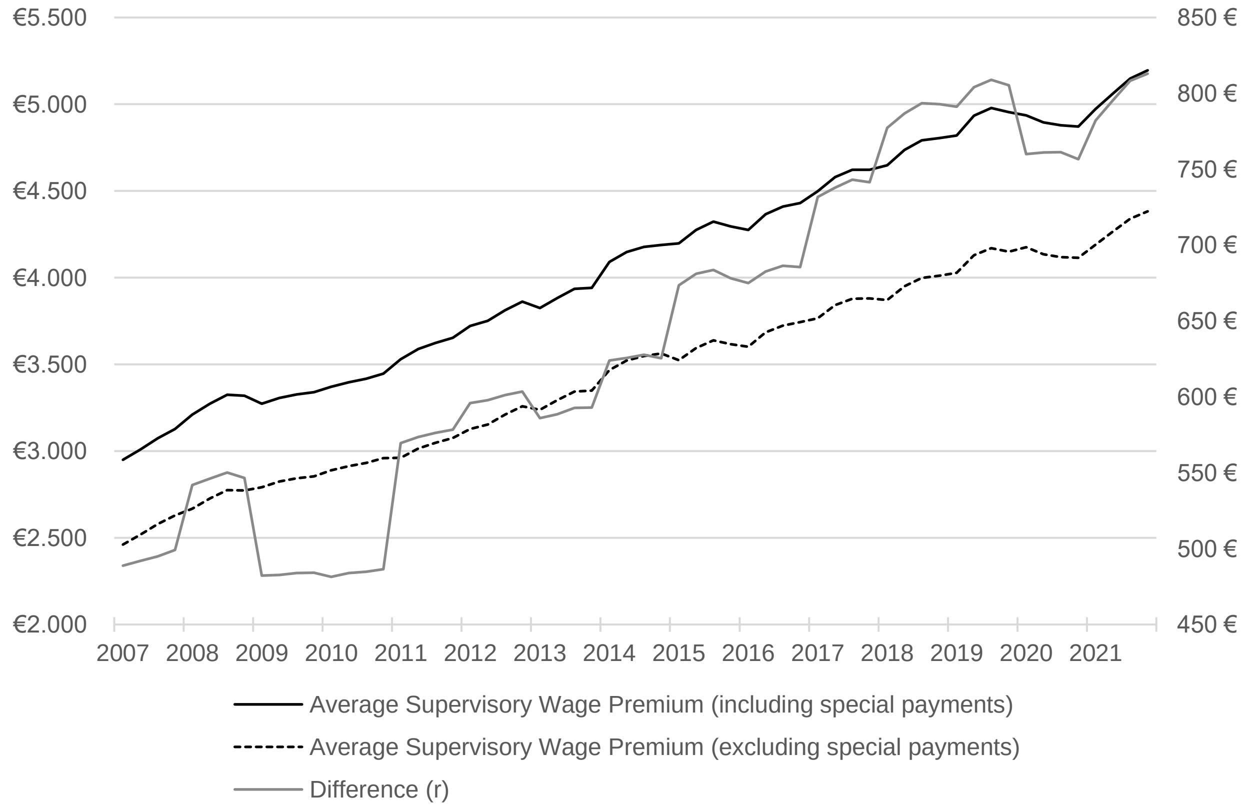
Comparing the results of the models in both orderings, several differences become apparent. In the following first the demand schedule will be discussed, before distributive dynamics are put into perspective of the conflicting theories.

In both models, baseline and alternative, as well as specifications of causal ordering, profit-led demand regimes are found for short-term data. Hence, the short-term demand schedule of the direct-wage-share appears relatively insensitive to the structure of the model. Disaggregating the wage-share though, diminishes the negative response of capacity utilization to the direct-wage-share, especially in the 'K'-

specification. While this might be interpreted in terms of short-term demand effects (Palley, 2017), one must think about the different reactions of capacity utilization to a shock in the supervisory-wage-share. While both are on average and aggregated after 10 periods negative, the 'G'-ordering presents a period of 3 quarters in which a shock positively influences capacity utilization (which might be interpreted as brief inequality-led demand (Tavani & Vasudevan, 2014)).

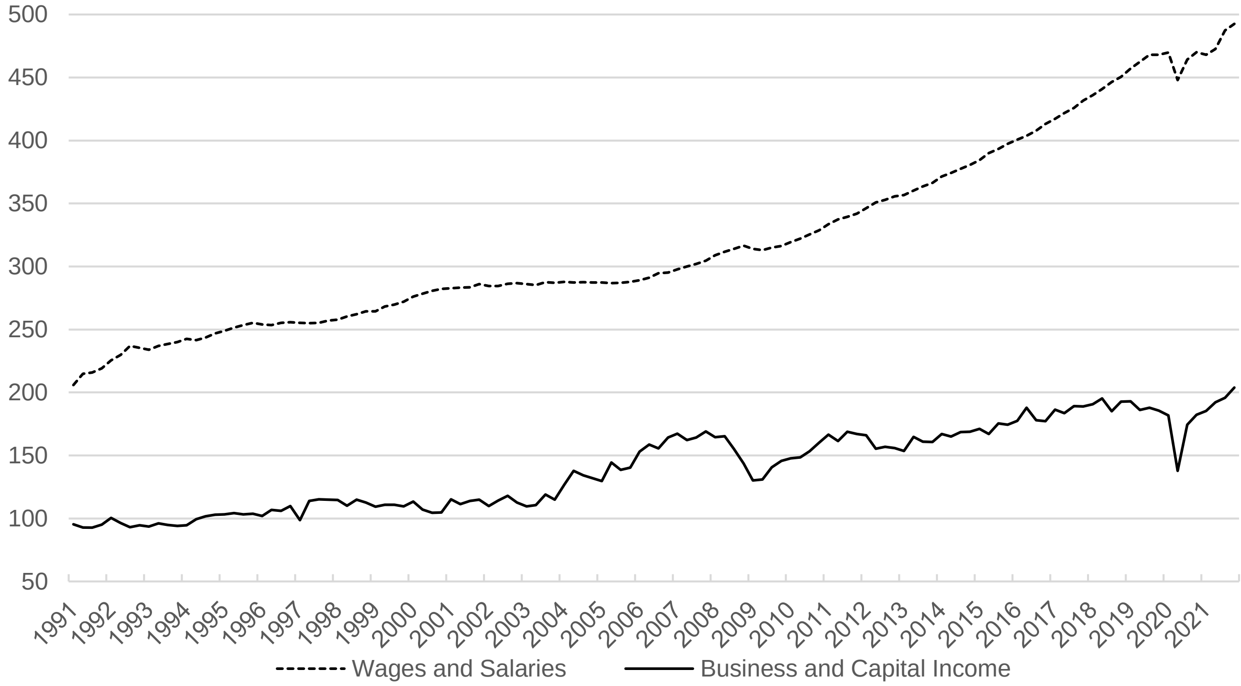
Lavoie and Nah (Lavoie & Nah, 2020) argue, that under certain conditions, profit-led results might arise due to an increase in the target rate of profits or the wage-premium of supervisory labour, and are more likely when the propensity of managers to save is close to zero. A look at the quarterly earnings survey (Figure 10) reveals that indeed the differences between average monthly real wages (in 2015 prices) of supervisors (LG1) and the average wage of direct workers (LG2-5 and marginally employed) is increasing. While measuring the target rate of profit is empirically challenging, the found increase in the wage-premium might substantiate the claim of Post-Kaleckian authors that these effects might play a more important role, than previously accepted.

Figure 10: Supervisory Monthly Wage Premium in 2015 Prices, 2007-2021 Quarterly



Data: Destatis (Destatis 2022a), authors elaboration.

Figure 11: National Income in Billion €, 1991-2021 Quarterly



Data: Destatis (Destatis 2022f), authors elaboration.

Another explanation of these results might be of rather statistical nature in combination with German labour market regulations. Looking at the reason for the increase of the (direct-) wage-share in times of low capacity utilization (spikes in Figure 3), I find that this is due to decreasing rate of profits and a stable employee compensations (see Figure 11). As firms cannot instantaneously fire workers or decrease wages for direct labour[1] due to labour regulations and collective wage agreements, while bonuses for supervisors are more flexible to change for firms, the spikes of the supervisory-wage-share are less pronounced. Comparing the distance between the two supervisory wage premiums including and excluding bonuses (Figure 10), we see that the importance of bonuses in the wage premium of supervisors is rising steadily. Only in periods of crisis the lines go in parallel or get closer to each other, indicating a decrease in the importance of bonuses in the wage premium.

Estimating a VAR with a lag of 4 quarters (only one year) associates the lower capacity utilization with the (artificial) increase in the wage-share, not identifying the cause for

[1] Wage cost experienced by firms might be decreased fast, but the wage-income received stays relatively stable due to unemployment benefits and special labour market instruments ("kurzarbeiter*innengeld").

the crisis which might have a variety of (exogenous) reasons like supply shocks due to a pandemic, a global financial crises, or the already mentioned increase in the target rate of profit (Lavoie & Nah, 2020; Marglin & Bhaduri, 1988). The found responses might be as such the result of the chosen coarseness of data, misidentification, and omitted variables.

Summing up, to categorize the demand schedule as profit-led might be a too easy explanation for the complexity of the relationships discussed. A smaller response of capacity utilization to the direct-wage-share compared to the aggregated wage-share might indicate differing propensities to consume between direct workers and supervisors provides some evidence for those scholars arguing for the importance of personal income distribution to aggregate demand.

The short-term results of the distribution schedule on the other hand are highly sensitive to the structure of the model. Here the cumulated effects after 10 periods change sign, when the structure of the model is changed. The distribution schedule switches from profit-squeeze to wage-squeeze for the same data and hence supports both theories dependent on the specification of contemporaneous effects. The neo-Goodwinian ordering narrative must explain the stronger increase of supervisory wages by an increased bargaining power of supervisors (compared to the power of direct workers and capital) over the cycle. Altering the order of contemporaneous causations to the Kaleckian narrative, the wage-share is found to be countercyclical with a changing composition of the wage-share by a on average slightly stronger decrease in the wage-share of supervisors compared to that of direct workers and corresponds to the underlying theory of overhead-labour as a fixed cost for capitalists. A comparison cumulated results can be found in Table 5 and Table 6.

Table 5: Comparison of Cumulated Effects from Baseline AIRFs in Neo-Goodwinian ordering (G) and Post-Kaleckian ordering (K) after 10 quarters

		Impulse Variable			
		Capacity Utilization		Wage-Share	
	Ordering:	G	K	G	K
Response	Capacity Utilization	(0)	+	-	-
	Wage-Share	+	-	+	+

Detail: Brackets mean that confidence-intervals spread across the zero-line.

Table 6: Comparison of Cumulated Effects from Alternative AIRFs in Neo-Goodwinian ordering (G) and Post-Kaleckian ordering (K) after 10 quarters.

		Impulse Variable					
		Capacity Utilization		Direct-Wage-Share		Supervisory-Wage-Share	
	Ordering:	G	K	G	K	G	K
Response	Capacity Utilization	(+)	+	-	-	(-)	(-)
	Direct-Wage-Share	(+)	-	+	+	(+)	(+)
	Supervisory-Wage-Share	(+)	(-)	+	+	(+)	+

Detail: Brackets mean that confidence-intervals spread across the zero-line.

3.2. Medium-Term: 1991 - 2017

In this section a medium-term analysis with annual data between 1991 and 2017 is conducted to contrast the findings above. In the next sub-section, the process of data assembly is described before an estimation is conducted comparing the baseline model to the alternative model with a disaggregated wage-share. Before discussing the results, the sensitivity to theoretical assumptions is checked by re-estimating the model in the alternative ‘K’-structure.

3.2.1. Data

Unfortunately, comparable, and consistent wage-surveys are not available before 2007 as they only capture industrial workers and no information on the position in the hierarchy of the production process is available. In this thesis I will attempt to overcome this limitation by approximating a disaggregated wage-share utilizing annual tax-data.

The approach is inspired by Dünhaupt (Duenhaupt, 2011) who computes a wage-share adjusted for the top 1% of wage-earners based on data of Bach et. al. (Bach et al., 2007). Dünhaupts adjusted wage-share is the p99Wage-share and excludes the top1%-share as their income is assumed to be closer related to capital, than to labour.

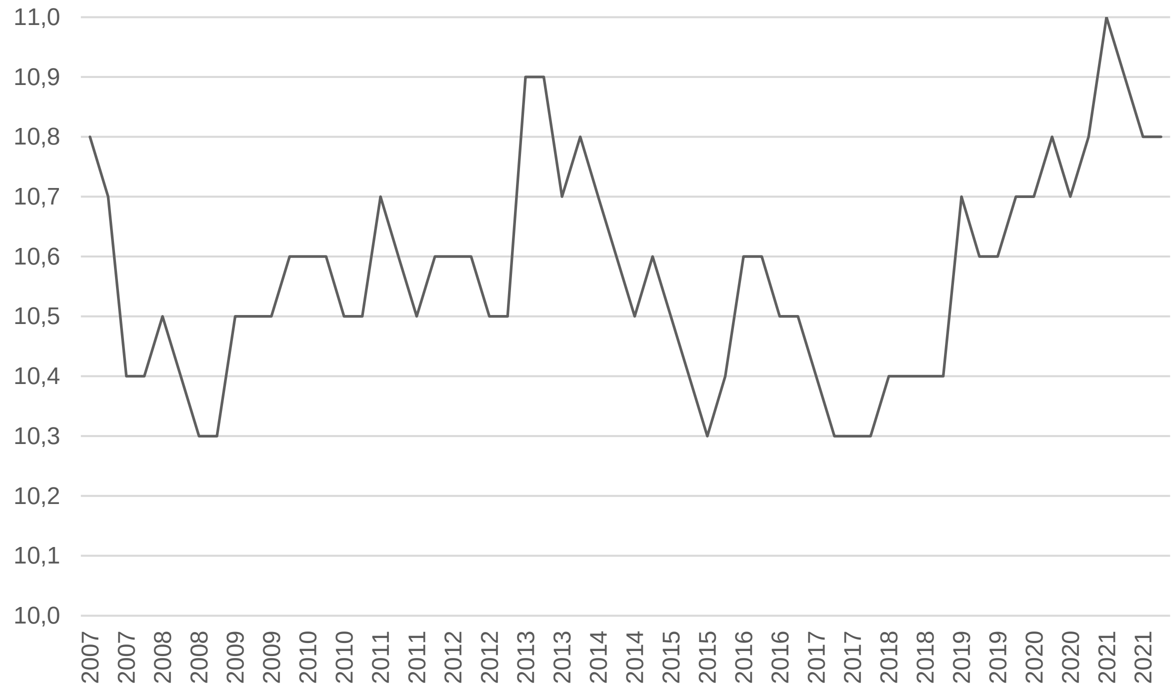
Reliable information on the 1% of top wage-earners are not available for more than a handful of years, as the combination of the Socio Economical Panel Survey (SOEP) with tax-data is not possible anymore and Bach and colleagues have not proceeded with their comprehensive dataset on income distribution in Germany due to funding and possible legal restrictions. However, the quarterly Income survey (above) suggests that rather 10% of wage earners are supervisors (Figure 12) and it appears reasonable from the data to assume that supervisors earn the highest average wages. Following these cautious assumptions, the Supervisory-wage-share for the medium-term analysis will be defined as top 10% of wage-earners. I’ll go forth and approximate the disaggregated wage-shares such that:

$$SWS := WS_{q90-100} = \frac{\sum Wages_{q90-100}}{\sum Wages} * WS$$

$$DWS := WS_{q0-90} = \frac{\sum Wages_{q0-90}}{\sum Wages} * WS = (1 - SWS) * WS$$

As the federal tax data is only providing information on (inconsistent) income groups, number of individuals in these groups and sum of taxed wage-income, the top decile is computed by splitting the closest category above the 10% mark of individuals. I subtract the average personal income of the number of individuals above the 10% from the top 10 % sum of wages and add these subtracted wage incomes to the 90% sum of wages.

Figure 12: Supervisors in % of Full-Time Employees



Data: Destatis (2022a), authors elaboration.

The wage-share is computed as elaborated in 3.1.1. and the rate of capacity utilization are taken as their annual averages. The result is a long time-series spanning from 1971 to 2017 (Figure 13). It must be noted that data before 1980 should be treated with caution, as figures of national accounting from earlier periods were apparently not subject to proper revision. Additionally, data before 1991 is not easily comparable with data after 1991, as the process of ‘reunification’ brought several changes to the statistics. For the estimation, only data after 1991 was utilized. This data is most reliable and consistent surveys for capacity utilization are only available after 1991.

Interestingly, supervisory-wage-share and direct-wage-share show on this level of magnification a negative correlation. It appears that when the direct-wage-share falls, the supervisory-wage-share increases, and vice-versa. While the direct-wage-share fell substantially over the sampled period, as did the aggregated wage-share, the supervisory share of gross value-added rose (see Figure 13). Differences in the level of the wage-share in 2017 in the long-term sample, compared to the one computed from short-term data are mainly due to the seasonal adjustment of the quarterly data.

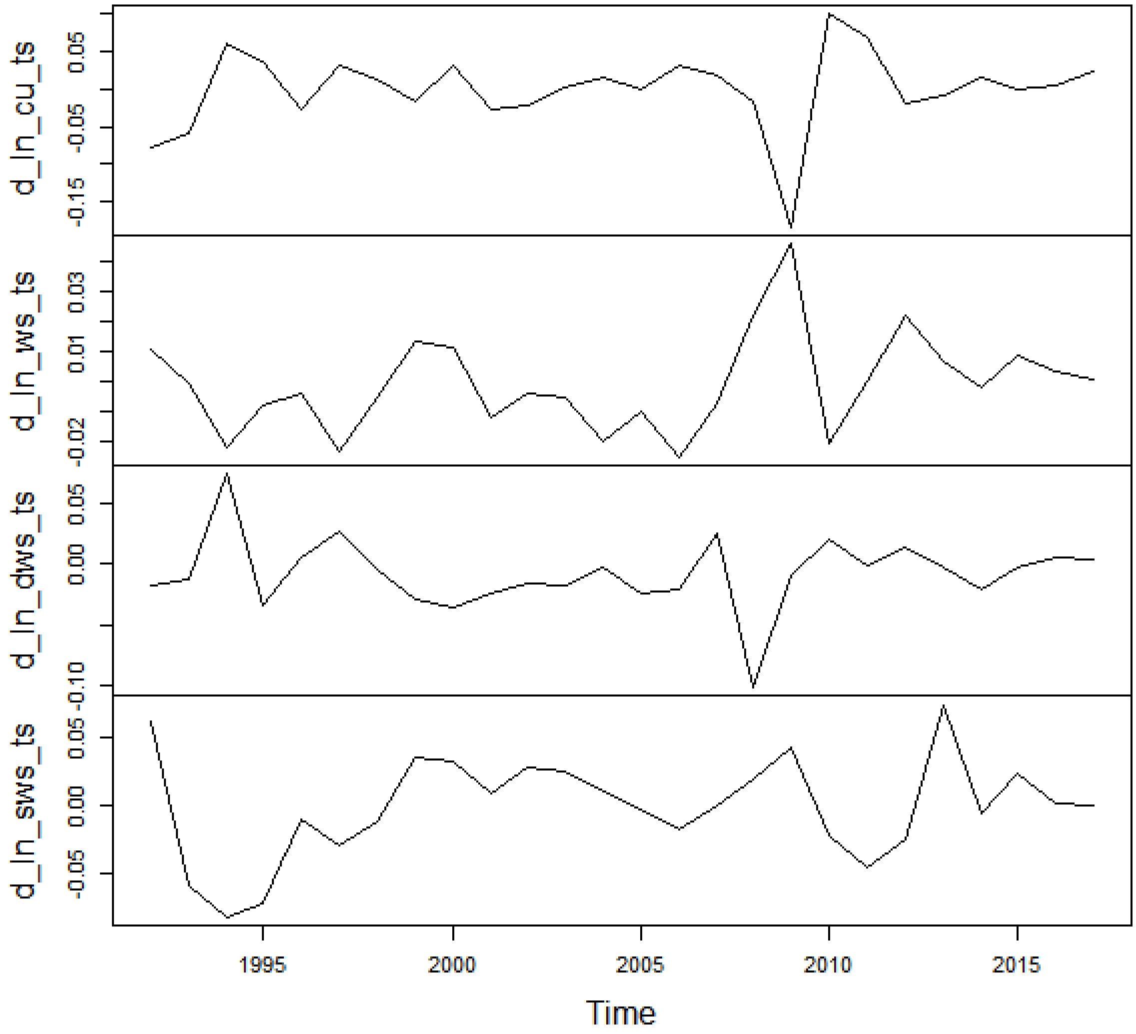
Figure 13: Wage Share in Germany 1971-2017 Disagregated in adjusted (/Direct-) Wage-Share and of Top Income Decile (Supervisory-) Wage-Share and Industrial Capacity Utilization (r.) 1991-2017

Data: Destatis (1977; 1978; 1979; 1980; 1981; 1982; 1983; 1984; 1985; 1986; 1987), Destatis (2022d), Destatis (2022e), Destatis (1977; 1978; 1982; 1984; 1987; 1991; 1995; 1998; 1999; 2004; 2009; 2009; 2012; 2016; 2016; 2017; 2018; 2019; 2020; 2021), ifo (2022), authors elaboration.
Details: Stars mark the years with available tax data. Missing values are linearly interpolated.

3.2.2 Estimation

To prepare the dataset for the forthcoming estimation, all values are log-transformed and taken to their first difference to obtain changes in percent and achieve stationarity of all variables (see Figure 14). All conducted tests (Table 7) indicate that the transformation was effective in achieving stationarity of the time-series.

Figure 14: Overview over Transformed Medium-Term Data



Data: Destatis (2022d), Destatis (2022e), Destatis (1991; 1995; 1998; 1999; 2004; 2009; 2009; 2012; 2016; 2016; 2017; 2018; 2019; 2020; 2021), ifo (2022), authors elaboration.
Details: All data log-transformed and differenced.

Table 7: Tests for Stationarity of Medium-Term Data

	Augmented Dickey Fuller test		**Phillips-Perron-Test**		**KPSS-Level-Test**	
H0:	At least 1 Unit-Root		At least 1 U-R		0 U-R	
Variable:	t-statistic	p-value	t-stat	p-value	LM-stat	p-value
D(ln(cu))	-4.8513	0.0002067	-6.0905	0.01	0.18955	0.1
D(ln(ws))	-3.4165	0.007693	-4.3596	0.01071	0.22571	0.1
D(ln(dws))	-2.8132	0.003398	-5.6582	0.01	0.38717	0.08269
D(ln(sws))	-3.3123	0.005897	-4.38	0.01	0.17855	0.1

Table 8: Granger Causality Tests for MT-Baseline-Estimate

Null hypothesis	***F-Test***	***df***	***p-value***
D(ln(ws)) does not granger-cause D(ln(cu))	0.2386	7	0.9651
D(ln(cu)) does not granger-cause D(ln(ws))	0.8267	7	0.5877
	Chi-squared	***df***	***p-value***
D(ln(ws)) does not instantaneously granger-cause D(ln(cu))	5.2133	1	0.02241
D(ln(cu)) does not instantaneously granger-cause D(ln(ws))	5.2133	1	0.02241

Figure 15: AIRFs of the Baseline MT-Estimate in 'G'-Ordering

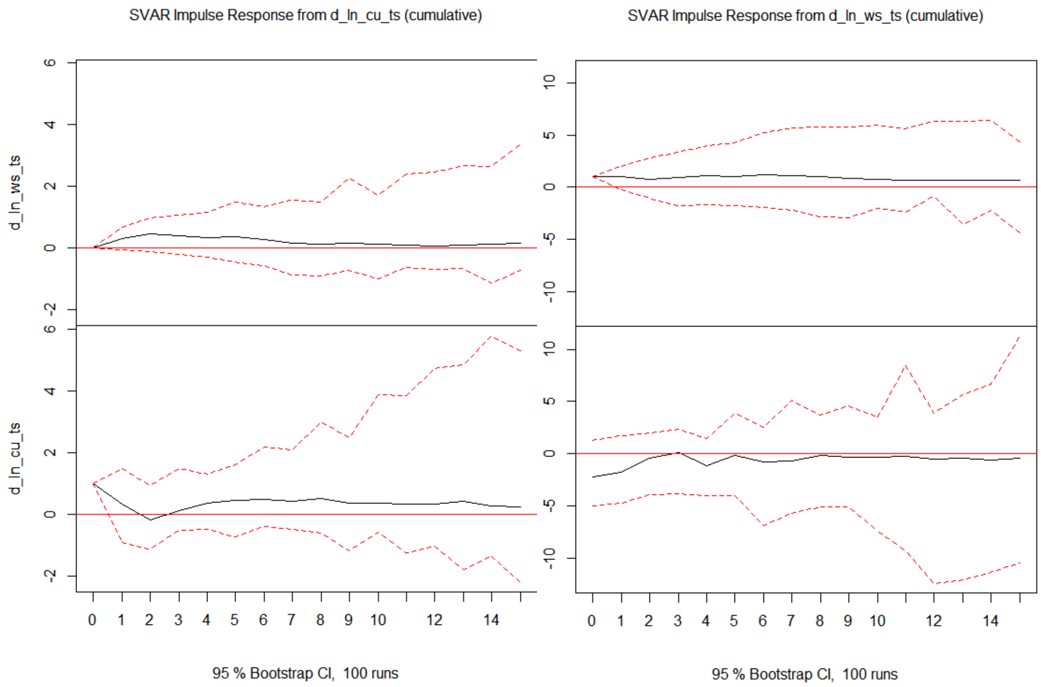


Table 9: Granger Causality Tests for MT-Alternative-Estimate

Null hypothesis	***F-Test***	***df***	***p-value***
D(ln(dws)) does not granger-cause D(ln(cu)), D(ln(sws))	9.7851	10	0.0
D(ln(sws)) does not granger-cause D(ln(sws)), D(ln(cu))	4.0939	10	0.00461
D(ln(cu)) does not granger-cause D(ln(dws)), D(ln(sws))	3.5915	10	0.008925
	Chi-squared	***df***	***p-value***
D(ln(dws)) does not instantaneously granger-cause D(ln(cu)), D(ln(sws))	4.9798	2	0.08292
D(ln(sws)) does not instantaneously granger-cause D(ln(dws)), D(ln(cu))	6.4194	2	0.04037
D(ln(cu)) does not instantaneously granger-cause D(ln(dws)), D(ln(sws))	7.658	2	0.02173

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Choosing the appropriate length of lags is aided again by a variety of criteria. The AIC, HW and SC indicate a lag of 7, while the FPE advises 8 lags. For the estimation 7 lags are chosen. Tests for Granger-causality (Table 8) finds interestingly that we cannot dismiss the null-hypotheses that neither D(ln(ws)) causes D(ln(cu)) nor D(ln(cu)) causes D(ln(ws)). Regarding instantaneous granger-causations, the test suggest that we cannot dismiss the hypothesis of no causation. Which contrasts with the test for short-term data. Estimating the VAR yields results which are presented in Table 20. Imposing structural restrictions of the type suggested by Neo-Goodwinians (G) produces Matrix A (Table 21). The combination of the obtained structural matrix A with the var-estimate allows us to compute AIRFs, which are presented in Figure 15. Reponses of the variables to shocks are weak and indetermined in their direction when considering confidence-intervals. Ignoring these, the demand regime might be characterized as weakly profit-led although the effect appears to die out after 15 periods. In terms of the distribution schedule, a unit shock of capacity utilization leads initially to a positive response of the wage-share. But this dies out too, indicating a short-term profit-squeeze, and a slightly procyclical wage-share.

For our alternative model all criteria indicate a lag of 5. The results of the var-estimates can be found in Table 23. For the disaggregated model tests of granger causality (Table 9) suggest us to dismiss the null-hypotheses of no granger-causation. Regarding instantaneous granger-causality we can dismiss the hypothesis of no granger-causality at the 10%-level. Nevertheless, structural restrictions on contemporaneous effects are imposed by estimating an A-matrix (Table 21).

Looking at dynamics of distribution (Figure 16), a unit shock of capacity utilization leads to a slight increase in the wage-share in the first year which switches on average to a 2% decrease of the wage-share after 15 years, although confidence intervals stretch slightly in both realms. A unit shock in capacity utilization decreases the supervisory-wage-share on average slightly in the first two periods before fluctuating between positive and negative changes until year 7 and remains slightly positive overall until the end of our observation. Although confidence intervals spread in both territories, one might interpret this result as a countercyclical supervisory-wage-share or a slight profit squeeze of supervisory-wages and a wage-squeeze of direct wages.

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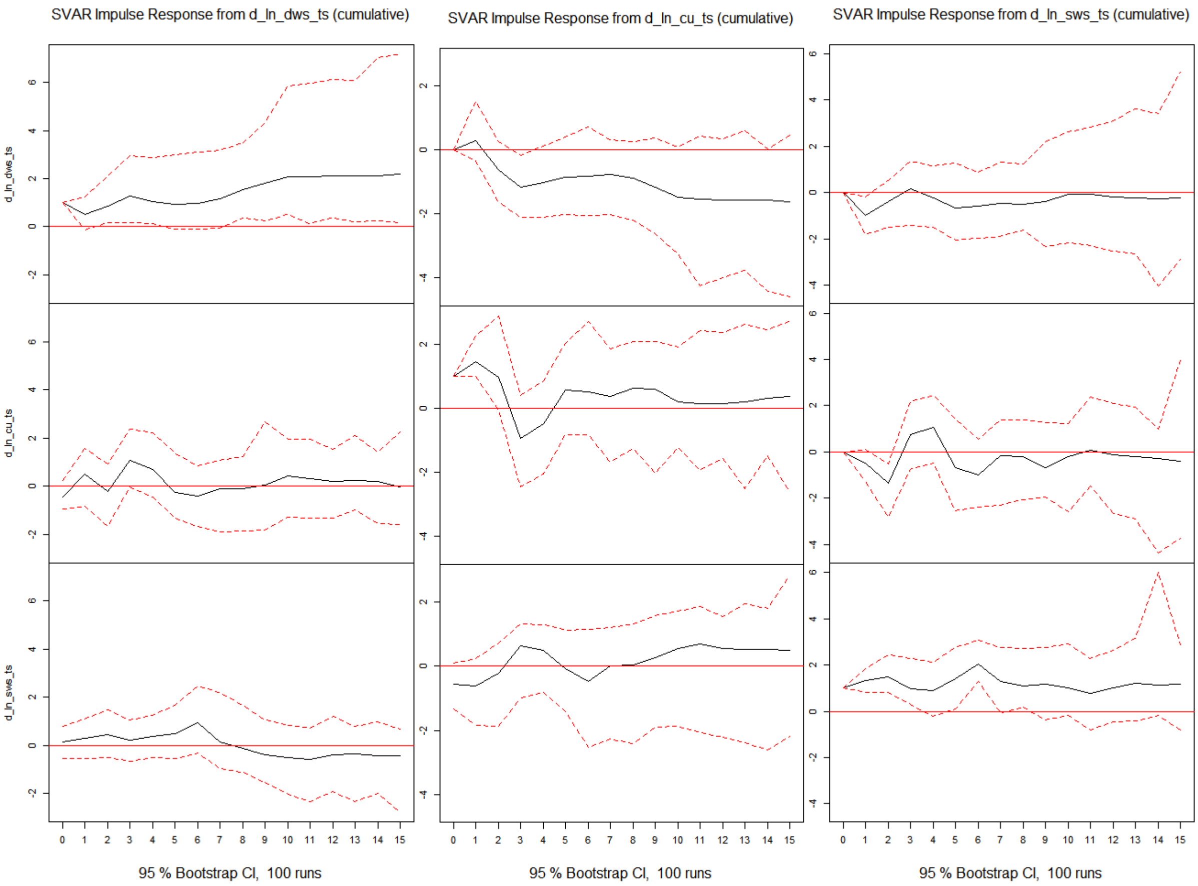
Analysing again the obtained AIRFs of the restricted model, the response of capacity utilization to a unit shock in the direct-wage-share fluctuates around zero with confidence intervals in negative and positive realm. Similar is the response of capacity utilization to a unit shock in the supervisory-wage-share, albeit slightly below the zero-line after 15 years. Hence, the demand-regime is only slightly determined by the disaggregated wage-shares, like in the aggregated result.

Figure 16: AIRFs of the Alternative MT-Estimate in 'G'-Ordering

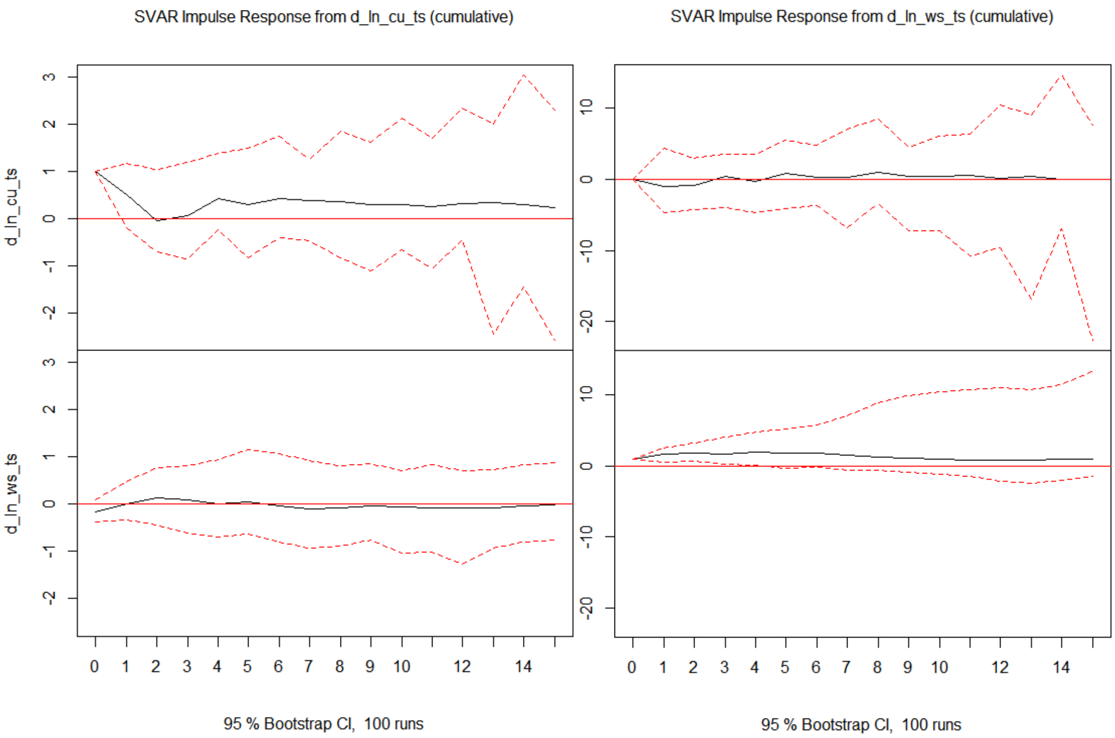


3.2.3 Sensitivity to alternative Cholesky-Ordering

Checking these results for their sensitivity to theoretical assumptions of contemporaneous causation expressed by structural Cholesky-ordering, I estimate again a VAR, test for Granger-causalities and obtain AIPRFs of the restricted VAR. As in the similar section on short-term data, the Neo-Goodwinian ordering utilized above is substituted by the Post-Kaleckian (for details refer to Table 1). The chosen lag of 7 was suggested by AIC, HQ and SC criterion, while FPE suggests 8. The estimated VAR is presented in Table 24. Imposing contemporaneous restrictions of the Post-

Kaleckian kind, an A-matrix (Table 25) is obtained, which allows us to construct AIRFs (Figure 17).

Figure 17: AIRFs of the Baseline MT-Estimate in 'K'-Ordering



Analysing these AIRFs, we find a unclear, on average zero, response of the wage-share to a unit-shock in capacity utilization after 15 years. While confidence intervals spread far into the positive as well as the negative realm, average values appear to follow a slight wave-pattern, starting negative, become slghtly positive in the second year, before becoming slightly negative again after the 6th year, indicating a slight wage-squeeze as the distributive regime. Similiarly the capacity utilization is not showing a strong response to a shock in the wage-share, although the pattern is less cyclical and confidence intervals widen towards the end of the sample, indicating wage-led demand regime.

To estimate the alternative model a lag of 5 is chosen, which is supported by all conducted tests. The estimated VAR is presented in Table 26. Imposing structural Cholesky-restrictions by an A-Matrix (Table 27), AIRFs of the restricted VAR are obtained (Figure 18).

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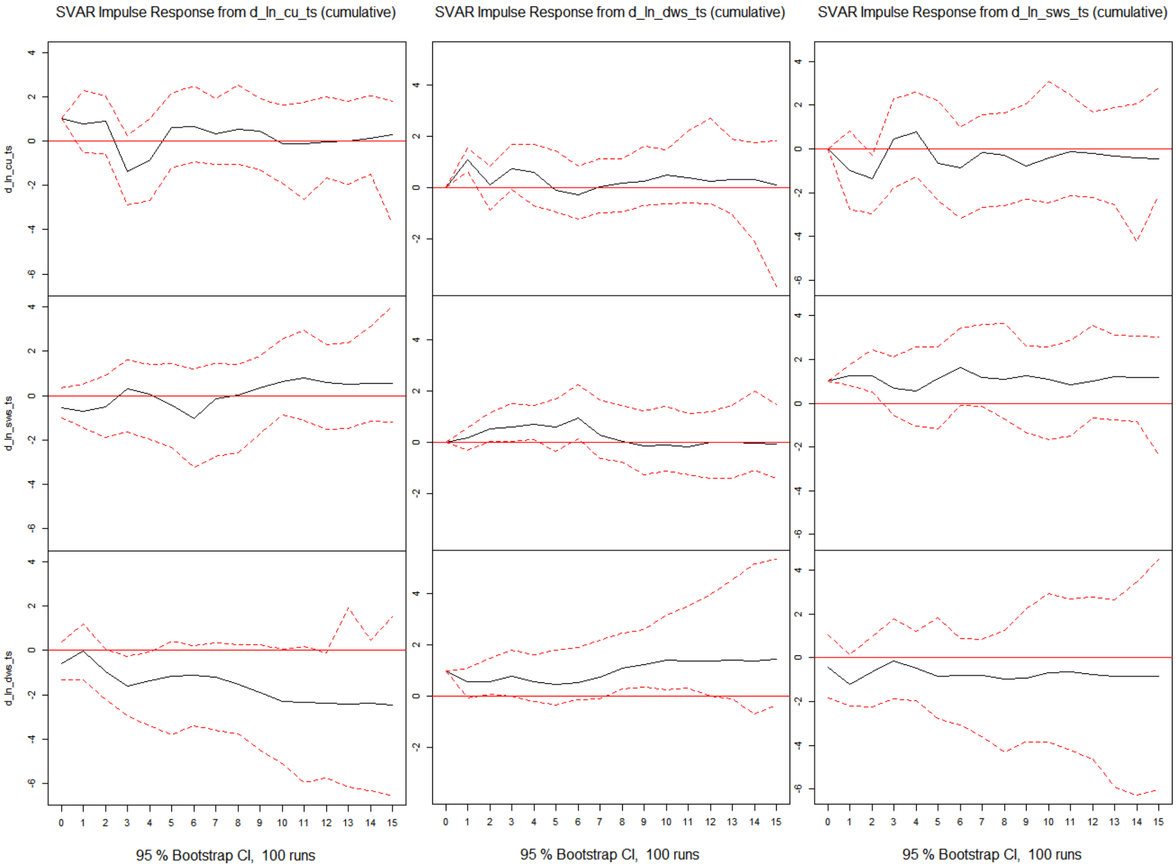
Figure 18: AIRFs of the Alternative MT-Estimate in 'K'-Ordering



The responses of the wage-shares differs upon an unit shock of capacity utilization: While the direct-wage-share reacts negatively to a shock in capacity utlization, the supervisory-wage-share reacts (on average), postively, after a small initial drop. While confidence intervals of the direct-wage-share are close to the zero-line, when in the positive realm, the confidence intervals of the supervisory-wage-share spread in both territories. Accordingly, the distributive regimes could be characterized as direct-wage-squeeze, but, considering our results from above (Figure 17), not only from profits, but also supervisory-labour, whose wage-share shows short-term fluctuations and initially a countercyclical character, before squeezing wages from direct-labor.

Considering the demand regime, neither unit shocks of the supervisory-wage-share nor the direct-wage-share show statistically significant responses of capacity utilization. Taking average values, a shock of the direct-wage-share triggers a slightly positive response, aside a brief dip in year 6 after the shock. This slight positive response could be interpreted by the faithful as a weakly direct-wage-led-demand.

Ignoring confidence intervals, the average response of capacity utilization to a shock of the supervisory-wage-share is negative, aside a brief positive period around year 4.

3.2.4. Discussion of Results

Comparing the results of the models in both orderings, several differences become apparent. I will discuss first the baseline model, than changes in confidence intervals when disagregating, and third, the distributive- and demand-regimes of the disagregated model.

The average responses of capacity utilization to the wage-share differs in the baseline models. While in the Neo-Goodwinian ordering a slightly profit-led result is obtained, the Neo-Kaleckian ordering classifies the demand remige as slightly wage-led. The same can be said about the distributive-schedule: While the G-ordering suggests a slight profit-squeeze, under 'K'-ordering the average response of the wage-share to a shock in capacity utilization is negative, indicating a slight wage-squeeze. Both theories find support for their respective narrative in the aggregated data, when appropriate structural restrictions are imposed.

When disaggregating the wage-share, both specifications of structural orderings present a clearer picture of demand- and distributive-regime with smaller confidence intervals. This is especially apparent when concerned with the demand-regime (responses of capacity utilization to changes in wage-shares), where confidence intervals decrease from +/- 10 percent points to +/- 4.

The disagregated results of the 'K'-ordered estimate are generally in line with those obtained through 'G'-ordered restrictions. The negative response of the direct-wage-share to capacity utilization is stronger in the 'K'-ordering, as is the positive distributive effect of capacity utiliation on the supervisory-wage-share. This distributive dynamics could show the importance of supervisory-wages for the business-cycle. A highly dynamic supervisory-wage share is found. Initially decreasing after a shock in capacity utilization, before gaining a larger part of the share 8 periods after the shock. This could be interpreted as supporting evidence for the countercyclicality of the supervisory-wage-share. The dynamic of the supervisory-wage-share is stronger when imposing 'K'-restrictions than 'G'-restrictions. A trade-off between the supervisory- and direct-wage-share becomes apparent.

Regarding the demand-schedule, the slightly negative responses of capacity utilization to a shock in the supervisory-wage-share could be interpreted in regards to the assumed propensities to save and consume of supervisors. Increases in the supervisory-wage-share could decrease aggregate demand stronger through decreased consumption and increased savings, than increasing aggregate demand through investment, as supervisory-wages are a cost to capitalists, decreasing profits and disincentivising investment. On the contrary, redistribution towards the direct wage-share could increase aggregate demand in the medium term slightly through the consumpton channel. However, the low level of both effects in the annual, medium-term, data might suggest that other (uncontrolled) demand components might play a larger role in determining capacity utilization, than solely the different factor-shares. An overview about aggregated cumulated responses can be fund in Table 10 and Table 11.

Table 10: Comparison of Cumulated Effects from Baseline AIRFs in Neo-Goodwinian ordering (G) and Post-Kaleckian ordering (K) after 15 Years

		Impulse Variable			
		Capacity Utilization		Wage-Share	
	Ordering:	G	K	G	K
Response	Capacity Utilization	(+)	(+)	(-)	(+)
	Wage-Share	(+)	(-)	(+)	(+)

Detail: Brackets mean that confidence-intervals spread across the zero-line.

Table 11: Comparison of Cumulated Effects from Alternative AIRFs in Neo-Goodwinian ordering (G) and Post-Kaleckian ordering (K) after 15 Years

		Impulse Variable					
		Capacity Utilization		Direct-Wage-Share		Supervisory-Wage-Share	
	Ordering:	G	K	G	K	G	K
Response	Capacity Utilization	(+)	(+)	(0)	(+)	(-)	(-)
	Direct-Wage-Share	(-)	(-)	+	(0)	(-)	(+)
	Supervisory-Wage-Share	(+)	(+)	(-)	(+)	(+)	(-)

Detail: Brackets mean that confidence-intervals spread across the zero-line.

4. Discussion of Short- and Medium-Term Analysis

In this last section before the conclusion, the short-term and medium-term analysis are compared and discussed. First the found demand regimes are compared and interpreted according to the different theories, before second the distributive dynamic is analysed and interpreted. Third, limitations of the empirical estimates are discussed before policy recommendations are deduced from the preceding interpretation.

The short-term estimations of demand-regimes show a negative response of capacity utilization to a shock in the wage-shares, regardless of the structural restrictions imposed. As discussed above, this result might be misleading for a variety of reasons, including the choice of lags, periodicity of the data and omitted (exogenous) shocks and variables. Nonetheless, the decrease in the negative effect of a shock in the direct-wage-share to capacity utilization compared to the aggregated baseline estimate can be interpreted in terms of the differing propensities to consume of supervisors and direct workers as Palley and other argue (Carvalho & Rezai, 2016; Palley, 2017), and stresses the importance of disaggregation the wage-share when analysing short-term demand-regimes.

In the medium-term estimate the demand regimes are rather indetermined while for the baseline model the 'G'-ordered restrictions find weakly profit-led demand, 'K'-ordering finds weakly wage-led demand. Disaggregating the wage-share narrow the confidence intervals of the demand regimes substantially and nuance the understanding of demand effects. In both specifications an increase in the supervisory-wage-share decreased capacity utilization more than an increase in the direct-wage-share, which shows no ('G'-ordering) or a slightly positive ('K'-ordering) effect on capacity utilization. Again, the results of the estimates provide evidence for those scholars stressing the importance of differing propensities to consume and to save depending on personal income, and therefore personal income distribution for aggregate demand. In general, however, other components of aggregate demand seem to be more important for capacity utilization, than solely income shares of factors or distribution within factors (at least within labour). This is also substantiated by the lower statistical evidence of the tests of granger-causality, which indicate that some variables might be not (contemporaneously) caused by the others.

Comparing the results of demand regimes of the short- and medium-run one might interpret the results in line with Blecker (Blecker, 2016) and assert that cost effects experienced by capitalists lead to a stronger negative reaction of aggregate demand through the channel of investment demand in the short run, while in the medium run consumption demand effects would overweigh the negative effects on investment induced by an increased wage-share. This interpretation can be extended in two ways: First by stressing the importance of overhead labour and the supervisory wage-premium on the cost-side of capitalists deciding on short-term investment. An increase in the supervisory wage-premium could lower the profit-share as well as capacity utilization (Lavoie & Nah, 2020). Second, medium-term demand is likely less governed by domestic demand effects of investment and consumption as a simple closed economy models suggests. In the medium-term other demand components, like (semi-)autonomous consumption (Allain, 2015; Fiebiger, 2018; Fiebiger & Lavoie, 2019) and foreign markets (Hein & Vogel, 2008) might play a more substantial role in a large open economy as the Federal Republic of Germany.

The findings of distributive dynamics are highly sensitive to changes in the structural ordering. In the short-term analysis 'G'-ordered AIRFs indicate profit-squeeze distributive regimes with a stronger positive reaction of the supervisory-wage-share in the disaggregated alternative model. Following the (Neo-)Goodwinian narrative based on the scarcity of labour (reserve army) and increasing bargaining-power of labour over the cycle, this would imply a stronger increase in the bargaining-power of supervisors, than direct workers, which is hard to combine with the assumption (and stylized fact, see Figure 12,) of supervisory-employment as relatively stable over the cycle. The results obtained by an alternative ordering of contemporaneous effects ('K'-ordering) can be interpreted in favour of the theory of the cycle presented by Lavoie and Nah (Lavoie & Nah, 2020). In the baseline model the profit-share is procyclical (sometimes referred to as wage-squeeze distributive regime) and disaggregation of the wage-share in the alternative model shows a slightly stronger decrease of the supervisory- compared to the direct-wage-share, when subject to a shock in capacity utilization, substantiating the idea of a counter cyclical supervisory-wage-share in the short-term and a change in the composition of labour towards direct labour over the cycle.

Results of the medium-term distributive regimes are less sensitive to changes in the ordering of contemporaneous restrictions, especially when disaggregating the wage-share. In the baseline model both structural specifications find effects very close to zero which could be interpreted in support of their respective reasonings, ('G': profit-squeeze. 'K': wage-squeeze). In the alternative model however, it becomes apparent that both find a strong squeeze of the direct-wage-share as the response to an increase in capacity utilization and a step-like reaction of the supervisory-wage-share, first countercyclical, then on average after 15 years, procyclical.

This result might be biased due to the different proxies used for supervisory labour (I will discuss them below), but assuming the proxy to be faithful to reality, several interpretations comparing the results of the distributive schedules in the short- and medium-term can be drawn: First, the procyclical (direct-)wage-share in the quarterly-data is not reproduced in the medium-term data, which questions the wage-bargaining hypothesis of neo-Goodwinians. Secondly, a direct-wage-squeeze is found in all AIRFs, despite the short-term estimate in 'G'-ordering. This could on the one hand be interpreted as a classical wage-squeeze in which wages grow slower than productivity, due to the respective price-setting powers of capital and labour. Alternatively, considering the post-Kaleckian model (Lavoie & Nah, 2020), this might be induced by the increasing wage-premium of supervisory-labour. Supervisors claiming a higher wage premium might explain the step-like shape of the reaction of the supervisory-wage-share to a shock in capacity utilization: While the productivity-effects induced by higher capacity utilization change initially the composition of labour towards a higher proportion of direct-labour and decrease the supervisory-wage-share (also observable in the short-term), adjustments of the amount of supervisors to new capacities as well as the higher wage-claims could lead to an overall increase of the supervisory-wage-share after 8 or 9 years of the shock in capacity utilization. Capitalists and managers together squeeze the wages of direct workers over the cycle, to ensure high profits as well as supervisory wages.

The conducted analysis has several limitations, some of which already mentioned above. The first and most striking one is the questionable comparability of short- and medium-term data. Not only is medium-term data estimated with a proxy of supervisory labour, due to the unavailability of direct data on supervisors before 2007, but it is also likely that the structure of the economy, desired rates of capacity utilization and the respective price setting powers of capitalists, managers, and direct workers, has changed after the crises of 2008/9.

Secondly, this ties into the critique of omitted variables of the simple econometric model used here. Some of the most relevant variables omitted certainly include unexplored components of aggregate demand like exports, government spending and debt. But also variables grasping changes in claims like the target rate of profit, wages, and the wage-premium of supervisors, as well as the respective bargaining and price-setting powers, which are important for the analysis but rarely directly estimated due to a lack of direct data and inconclusive theoretical reasonings on the determinants of these variables for indirect estimates.

Third, the chosen model in the specification adapted from the existing literature is unable to differentiate exogenous from endogenous shocks and treats all changes of the system as endogenous. This becomes apparent when considering the latest crisis induced by a global pandemic, which restricted not only demand but merely supply of goods and the forced closing of productive capacities for health reasons, which is not generated by the feedback dynamics of distribution and demand modelled here.

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Despite the limitations, the analysis has shown that empirical studies might be biased towards finding profit-led results in the short-run. Although a direct switch of the demand regime in the short-term was not identified, when disaggregating the wage-share, the negative impact of the wage-share on capacity utilization was decreased, exemplifying the importance of the supervisory-wage-share in particular, and personal income distribution in general, for the character of the aggregate demand regime. The existence of overhead labour and conflicting claims between direct workers, managers and capitalists might give an alternative explanation for the profit-led results in the short-term.

The results were not only sensitive to the coarseness of the analysed data, but also sensitivity to changes in the ordering of contemporaneous effects. This highlights the need to be cautious with empirical findings, as empirics can only show what its methods test for. The results can be interpreted in favour of authors who reason different time-horizons of the impacts of cost effects (fast) on investment demand and wage-income effects (slow) on consumption demand (Blecker, 2016). These different timeframes are especially important when considering the cost effect of “hoarded” overhead labour and their wage-claims.

According to my estimates of responses of capacity utilization to wage-share shocks, an increase in the direct-wage-share does not lead to a decrease in capacity utilization in the medium term. While a redistribution from direct-workers to managers by increasing the wage-differential might lead to relatively high profits and as such investment demand, managers propensity to consume might not be high enough (or fall) leading to a decrease of domestic consumption demand after some business cycles of redistribution towards managers. Whether this is strong enough to decrease capacity utilization effectively, depends heavily on exogenous components like exports. It is clear however, that a loss in domestic consumption demand makes the economy highly dependent on a smoothly working international trade to compensate for this demand component and exposes itself to considerable risk, not to speak of the macroeconomic imbalances arising in a shared monetary space as the EMU.

This does also mean that redistribution from profits to direct wages might decrease investment in the short-term, but this redistribution has no, or a positive effect on aggregate demand in the medium-term. An economy aimed at increasing long-term welfare would hence aim at more equitable wage policies: Limiting the growth of supervisory wages, increase the income of those with the lowest wages and invest in stable international institutions, infrastructures, and technical and social innovations to ensure high productivity growth, which could allow mutually benefitting redistribution and increased aggregate demand.

5. Conclusion

Aim of this paper was to understand the importance of within wage distribution for the business cycle in Germany at different timescales. After providing a brief review of the theoretical and empirical literature on demand and distribution as well as withing wage differences, I followed the empirical strategy of aggregative/systemic estimate in determining aggregate demand- and distributive-regimes simultaneously by analysing feedback effects of the variables onto each other and themselves. Structurally restricted Vector Auto Regressions (VAR) were estimated for two datasets, first in quarterly periodicity from 2007-2021 and second in annual periodicity from 1991-2017. By comparing the obtained Aggregated Impulse Response Functions (AIRFs) of a baseline model with an alternative model, which disaggregates the wage-share in the share of supervisory and direct wages, the effects of within wage distribution on aggregate demand are assessed in the medium- and the short-term. Simultaneously the distributive schedule is estimated, such that the dynamics of an increase in capacity utilization on factor-shares and distribution within the two wage-shares are quantified. All estimates are tested for their sensitivity to theoretical assumption on the contemporaneous effects of variables onto each other by imposing structural restrictions of the neo-Goodwinian narrative and testing these results sensitivity by a comparison with an ordering following the post-Kaleckian narrative.

For the short-term data a profit-led demand regime was identified which is insensitive to the structural ordering chosen. While a variety of reasons exist why this finding might not reflect the real character of aggregate demand (e.g., increasing wage-differentials between direct-workers and supervisors, omitted variables, endogenization of exogenous demand and supply effects), it is interesting to note that disaggregating the wage-share decreased the negative response of capacity utilization to an increase of the wage share and hence 'weakened' the finding of a profit-led demand regime in the short-term. The demand regime of medium-term data was undetermined (close to zero) and sensitive to the structural ordering chosen. Neo-Goodwinian ordering yielded weakly profit-led demand regime, while post-Kaleckian ordering pointed towards weakly demand-led aggregate demand, both supporting their respective theories of the cycle. Overall, including a differentiated wage-share lowered confidence intervals of demand regime AIRFs and improved our understanding of demand responses to distribution. While the effect of an increase in supervisory wages triggers a negative response of capacity utilization in both disaggregated specifications, an increase of the direct-wage-share has no (neo-Goodwinan) or a positive (post-Kaleckian) effect on economic activity in the medium-term.

Regarding distributive dynamics, the chosen structural restrictions influence the outcome more in the short-term than the long-term analysis. While in the short-term and the disaggregated baseline model both find support for their respective theories (neo-Goodwinian: procyclical vs post-Kaleckian: countercyclical wage-share) these differences disappear when disaggregating the wage-share in the medium-term. The slight profit-squeeze found in the aggregated model under 'G'-ordering is driven by the supervisory-wage-share. It initially behaves countercyclical before achieving redistribution not only from direct wages but also profits. One possible explanation might be due to increased bonus- and wage-claims of supervisors over several shorter cycles. In both specifications the direct-wage-share is found to be countercyclical in the medium-term.

I find support for the hypothesis that disaggregating the wage-share is important for empirical studies of the demand and distributive regimes. Studies might be biased towards finding (stronger) profit-led results and a procyclical wage-share when omitting personal income distribution and the special role of overhead labour. When conducting VAR estimates, special attention must be dedicated to structural restrictions, as they can drastically change the outcome of the AIRFs, often in support of the respective theory.

Researchers also must pay special attention to the timeframe and coarseness of data chosen. The results can be interpreted in favour of those arguing for profit-led demand regimes in the short-term and wage-led demand regimes in the medium-term, but these findings could be also due to other problems in the methodology as endogenizing exogenous effects and temporal identification problems, especially in presence of wage- and employment-hysteresis and changing claims of social classes.

One avenue for future research is certainly the improvement of econometrical methods to provide conclusive evidence for the theoretical questions raised. The one exercised here is certainly not able to do so.

Another avenue would be geared towards other forms of disaggregation, for example estimate interacting sectoral or national business cycles, as well as gendered cycles. The quarterly data for Germany would allow such an investigation. Continuous theoretical and empirical models of distribution on demand, not only separating two classes with differing propensity to consume but combining a function of the propensity to consume with estimates of the wage-income distribution would even further nuance our understanding of within-wage differences and demand. Completing this with a distributive model which allows for flexible priming of functions on the distribution of profits, wages and salaries could allow us to model aggregate demand for cases in which the return from capital would be more or less equally distributed.

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xx. Appendix

Table 12: VAR Baseline Model Output ST-Data in G-Ordering

d_ln_ws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_ws_ts.l1	0.4785	0.2254	2.12	0.0390
d_ln_cu_ts.l1	0.2827	0.0923	3.06	0.0036
d_ln_ws_ts.l2	-0.0862	0.2525	-0.34	0.7343
d_ln_cu_ts.l2	-0.1872	0.0960	-1.95	0.0570
d_ln_ws_ts.l3	0.2266	0.2555	0.89	0.3798
d_ln_cu_ts.l3	0.2069	0.1046	1.98	0.0539
d_ln_ws_ts.l4	0.5323	0.1935	2.75	0.0084
d_ln_cu_ts.l4	0.0965	0.0762	1.27	0.2120

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_ws_ts.l1	-1.8950	0.5591	-3.39	0.0014
d_ln_cu_ts.l1	-0.4152	0.2289	-1.81	0.0761
d_ln_ws_ts.l2	-0.1383	0.6265	-0.22	0.8263
d_ln_cu_ts.l2	0.3222	0.2381	1.35	0.1824
d_ln_ws_ts.l3	-0.4393	0.6340	-0.69	0.4918
d_ln_cu_ts.l3	-0.2706	0.2596	-1.04	0.3024
d_ln_ws_ts.l4	-1.1091	0.4802	-2.31	0.0253
d_ln_cu_ts.l4	-0.4292	0.1892	-2.27	0.0279

Table 13: Estimated A-Matrix of Baseline ST-VAR in G-Ordering

	d_ln_ws_ts	d_ln_cu_ts
d_ln_ws_ts	1	0
d_ln_cu_ts	1.97	1

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Table 14: VAR Alternative Model Output, ST-Data, G-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	-2.0913	0.6626	-3.16	0.0031
d_ln_cu_ts.l1	-0.2617	0.2693	-0.97	0.3371
d_ln_sws_ts.l1	0.4235	0.4944	0.86	0.3969
d_ln_dws_ts.l2	-0.8093	0.7585	-1.07	0.2925
d_ln_cu_ts.l2	0.2114	0.2730	0.77	0.4434
d_ln_sws_ts.l2	0.4493	0.4419	1.02	0.3155
d_ln_dws_ts.l3	-0.5113	0.7584	-0.67	0.5041
d_ln_cu_ts.l3	-0.1379	0.2800	-0.49	0.6251
d_ln_sws_ts.l3	0.1365	0.4750	0.29	0.7754
d_ln_dws_ts.l4	-1.0776	0.7573	-1.42	0.1627
d_ln_cu_ts.l4	-0.3103	0.2862	-1.08	0.2848
d_ln_sws_ts.l4	0.0938	0.4319	0.22	0.8291
d_ln_dws_ts.l5	0.6897	0.6711	1.03	0.3104
d_ln_cu_ts.l5	-0.2134	0.2355	-0.91	0.3705
d_ln_sws_ts.l5	-0.8227	0.4666	-1.76	0.0857

d_ln_dws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	0.3931	0.2701	1.46	0.1536
d_ln_cu_ts.l1	0.2538	0.1098	2.31	0.0261
d_ln_sws_ts.l1	0.0914	0.2015	0.45	0.6527
d_ln_dws_ts.l2	-0.1625	0.3092	-0.53	0.6022
d_ln_cu_ts.l2	-0.1801	0.1113	-1.62	0.1137
d_ln_sws_ts.l2	0.0404	0.1801	0.22	0.8238
d_ln_dws_ts.l3	0.2318	0.3091	0.75	0.4578
d_ln_cu_ts.l3	0.1776	0.1142	1.56	0.1279
d_ln_sws_ts.l3	-0.0506	0.1936	-0.26	0.7952
d_ln_dws_ts.l4	0.1098	0.3087	0.36	0.7240
d_ln_cu_ts.l4	-0.0212	0.1167	-0.18	0.8567
d_ln_sws_ts.l4	0.0708	0.1760	0.40	0.6896
d_ln_dws_ts.l5	-0.2526	0.2735	-0.92	0.3614
d_ln_cu_ts.l5	0.0330	0.0960	0.34	0.7329
d_ln_sws_ts.l5	0.0284	0.1902	0.15	0.8819

d_ln_sws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	1.1064	0.3586	3.09	0.0037
d_ln_cu_ts.l1	0.3441	0.1457	2.36	0.0233
d_ln_sws_ts.l1	-0.4327	0.2676	-1.62	0.1139
d_ln_dws_ts.l2	0.4533	0.4105	1.10	0.2763
d_ln_cu_ts.l2	-0.2450	0.1477	-1.66	0.1053
d_ln_sws_ts.l2	-0.4508	0.2392	-1.89	0.0669
d_ln_dws_ts.l3	0.6650	0.4105	1.62	0.1132
d_ln_cu_ts.l3	0.1924	0.1516	1.27	0.2118
d_ln_sws_ts.l3	-0.1698	0.2571	-0.66	0.5127
d_ln_dws_ts.l4	0.4969	0.4099	1.21	0.2327
d_ln_cu_ts.l4	0.1958	0.1549	1.26	0.2138
d_ln_sws_ts.l4	0.4272	0.2337	1.83	0.0752
d_ln_dws_ts.l5	-0.1837	0.3632	-0.51	0.6158
d_ln_cu_ts.l5	0.0925	0.1275	0.73	0.4722
d_ln_sws_ts.l5	0.3880	0.2525	1.54	0.1325

Table 15: Estimated A-Matrix of Alternative ST-VAR in 'G'-Ordering

	d_ln_dws_ts	d_ln_cu_ts	d_ln_sws_ts
d_ln_dws_ts	1	0	0
d_ln_cu_ts	1.9266	1	0
d_ln_sws_ts	-0.8756	0.1054	1

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Table 16: VAR Baseline Model Output ST-Data in 'K'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	-0.4152	0.2289	-1.81	0.0761
d_ln_ws_ts.l1	-1.8950	0.5591	-3.39	0.0014
d_ln_cu_ts.l2	0.3222	0.2381	1.35	0.1824
d_ln_ws_ts.l2	-0.1383	0.6265	-0.22	0.8263
d_ln_cu_ts.l3	-0.2706	0.2596	-1.04	0.3024
d_ln_ws_ts.l3	-0.4393	0.6340	-0.69	0.4918
d_ln_cu_ts.l4	-0.4292	0.1892	-2.27	0.0279
d_ln_ws_ts.l4	-1.1091	0.4802	-2.31	0.0253

d_ln_ws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.2827	0.0923	3.06	0.0036
d_ln_ws_ts.l1	0.4785	0.2254	2.12	0.0390
d_ln_cu_ts.l2	-0.1872	0.0960	-1.95	0.0570
d_ln_ws_ts.l2	-0.0862	0.2525	-0.34	0.7343
d_ln_cu_ts.l3	0.2069	0.1046	1.98	0.0539
d_ln_ws_ts.l3	0.2266	0.2555	0.89	0.3798
d_ln_cu_ts.l4	0.0965	0.0762	1.27	0.2120
d_ln_ws_ts.l4	0.5323	0.1935	2.75	0.0084

Table 17: Estimated A-Matrix of Baseline ST-VAR in 'K'-Ordering

	d_ln_cu_ts	d_ln_ws_ts
d_ln_cu_ts	1	0
d_ln_ws_ts	0.33	1

Table 18: VAR Alternative Model Output, ST-Data, 'K'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	-0.2617	0.2693	-0.97	0.3371
d_ln_sws_ts.l1	0.4235	0.4944	0.86	0.3969
d_ln_dws_ts.l1	-2.0913	0.6626	-3.16	0.0031
d_ln_cu_ts.l2	0.2114	0.2730	0.77	0.4434
d_ln_sws_ts.l2	0.4493	0.4419	1.02	0.3155
d_ln_dws_ts.l2	-0.8093	0.7585	-1.07	0.2925
d_ln_cu_ts.l3	-0.1379	0.2800	-0.49	0.6251
d_ln_sws_ts.l3	0.1365	0.4750	0.29	0.7754
d_ln_dws_ts.l3	-0.5113	0.7584	-0.67	0.5041
d_ln_cu_ts.l4	-0.3103	0.2862	-1.08	0.2848
d_ln_sws_ts.l4	0.0938	0.4319	0.22	0.8291
d_ln_dws_ts.l4	-1.0776	0.7573	-1.42	0.1627
d_ln_cu_ts.l5	-0.2134	0.2355	-0.91	0.3705
d_ln_sws_ts.l5	-0.8227	0.4666	-1.76	0.0857
d_ln_dws_ts.l5	0.6897	0.6711	1.03	0.3104

d_ln_dws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.2538	0.1098	2.31	0.0261
d_ln_sws_ts.l1	0.0914	0.2015	0.45	0.6527
d_ln_dws_ts.l1	0.3931	0.2701	1.46	0.1536
d_ln_cu_ts.l2	-0.1801	0.1113	-1.62	0.1137
d_ln_sws_ts.l2	0.0404	0.1801	0.22	0.8238
d_ln_dws_ts.l2	-0.1625	0.3092	-0.53	0.6022
d_ln_cu_ts.l3	0.1776	0.1142	1.56	0.1279
d_ln_sws_ts.l3	-0.0506	0.1936	-0.26	0.7952
d_ln_dws_ts.l3	0.2318	0.3091	0.75	0.4578
d_ln_cu_ts.l4	-0.0212	0.1167	-0.18	0.8567
d_ln_sws_ts.l4	0.0708	0.1760	0.40	0.6896
d_ln_dws_ts.l4	0.1098	0.3087	0.36	0.7240
d_ln_cu_ts.l5	0.0330	0.0960	0.34	0.7329
d_ln_sws_ts.l5	0.0284	0.1902	0.15	0.8819
d_ln_dws_ts.l5	-0.2526	0.2735	-0.92	0.3614

d_ln_sws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.3441	0.1457	2.36	0.0233
d_ln_sws_ts.l1	-0.4327	0.2676	-1.62	0.1139
d_ln_dws_ts.l1	1.1064	0.3586	3.09	0.0037
d_ln_cu_ts.l2	-0.2450	0.1477	-1.66	0.1053
d_ln_sws_ts.l2	-0.4508	0.2392	-1.89	0.0669
d_ln_dws_ts.l2	0.4533	0.4105	1.10	0.2763
d_ln_cu_ts.l3	0.1924	0.1516	1.27	0.2118
d_ln_sws_ts.l3	-0.1698	0.2571	-0.66	0.5127
d_ln_dws_ts.l3	0.6650	0.4105	1.62	0.1132
d_ln_cu_ts.l4	0.1958	0.1549	1.26	0.2138
d_ln_sws_ts.l4	0.4272	0.2337	1.83	0.0752
d_ln_dws_ts.l4	0.4969	0.4099	1.21	0.2327
d_ln_cu_ts.l5	0.0925	0.1275	0.73	0.4722
d_ln_sws_ts.l5	0.3880	0.2525	1.54	0.1325
d_ln_dws_ts.l5	-0.1837	0.3632	-0.51	0.6158

Table 19: Estimated A-Matrix of Alternative ST-VAR in 'K'-Ordering

	d_ln_cu_ts	d_ln_sws_ts	d_ln_dws_ts
d_ln_cu_ts	1	0	0
d_ln_sws_ts	0.4075	1	0
d_ln_dws_ts	0.2271	-0.2612	1

Table 20: VAR Baseline Model Output MT-Data in 'G'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_ws_ts.l1	-1.0325	2.0315	-0.51	0.6329
d_ln_cu_ts.l1	-0.6761	0.5552	-1.22	0.2776
d_ln_ws_ts.l2	0.0909	2.1782	0.04	0.9683
d_ln_cu_ts.l2	-0.6753	0.7147	-0.94	0.3881
d_ln_ws_ts.l3	0.7625	1.9869	0.38	0.7169
d_ln_cu_ts.l3	-0.3607	0.7398	-0.49	0.6465
d_ln_ws_ts.l4	-0.6939	2.0107	-0.35	0.7441
d_ln_cu_ts.l4	-0.4493	0.6958	-0.65	0.5470
d_ln_ws_ts.l5	1.6436	1.9803	0.83	0.4444
d_ln_cu_ts.l5	0.0184	0.6299	0.03	0.9778
d_ln_ws_ts.l6	-0.8429	2.0759	-0.41	0.7015
d_ln_cu_ts.l6	-0.1791	0.6017	-0.30	0.7779
d_ln_ws_ts.l7	0.6985	2.0146	0.35	0.7429
d_ln_cu_ts.l7	0.0382	0.6246	0.06	0.9536

d_ln_ws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_ws_ts.l1	0.6572	0.5597	1.17	0.2932
d_ln_cu_ts.l1	0.2977	0.1530	1.95	0.1092
d_ln_ws_ts.l2	-0.0163	0.6001	-0.03	0.9793
d_ln_cu_ts.l2	0.1505	0.1969	0.76	0.4793
d_ln_ws_ts.l3	0.0268	0.5474	0.05	0.9629
d_ln_cu_ts.l3	0.1051	0.2038	0.52	0.6282
d_ln_ws_ts.l4	-0.1415	0.5540	-0.26	0.8086
d_ln_cu_ts.l4	0.0456	0.1917	0.24	0.8214
d_ln_ws_ts.l5	-0.0246	0.5456	-0.05	0.9658
d_ln_cu_ts.l5	0.0591	0.1735	0.34	0.7472
d_ln_ws_ts.l6	-0.2879	0.5720	-0.50	0.6361
d_ln_cu_ts.l6	-0.1145	0.1658	-0.69	0.5203
d_ln_ws_ts.l7	-0.1692	0.5550	-0.30	0.7727
d_ln_cu_ts.l7	-0.0772	0.1721	-0.45	0.6726

Table 21: Estimated A-Matrix of Baseline MT-VAR in ‘G’-Ordering

	d_ln_ws_ts	d_ln_cu_ts
d_ln_ws_ts	1	0
d_ln_cu_ts	2.23	1

Table 22: Estimated A-Matrix of Alternative MT-VAR in ‘G’-Ordering

	d_ln_dws_ts	d_ln_cu_ts	d_ln_sws_ts
d_ln_dws_ts	1	0	0
d_ln_cu_ts	0.44994	1	0
d_ln_sws_ts	0.09992	0.546	1

Table 23: VAR Alternative Model Output, MT-Data, 'G'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	1.0988	0.2657	4.14	0.0061
d_ln_cu_ts.l1	0.1681	0.1773	0.95	0.3797
d_ln_sws_ts.l1	-0.4939	0.3510	-1.41	0.2090
d_ln_dws_ts.l2	-0.6363	0.2790	-2.28	0.0627
d_ln_cu_ts.l2	-0.6382	0.1672	-3.82	0.0088
d_ln_sws_ts.l2	0.4821	0.3448	1.40	0.2115
d_ln_dws_ts.l3	1.3324	0.3227	4.13	0.0062
d_ln_cu_ts.l3	0.1865	0.2529	0.74	0.4887
d_ln_sws_ts.l3	0.5691	0.3005	1.89	0.1071
d_ln_dws_ts.l4	-0.9523	0.3446	-2.76	0.0327
d_ln_cu_ts.l4	0.3189	0.2589	1.23	0.2642
d_ln_sws_ts.l4	0.0434	0.2490	0.17	0.8675
d_ln_dws_ts.l5	-0.6756	0.2883	-2.34	0.0576
d_ln_cu_ts.l5	-0.5467	0.1928	-2.84	0.0298
d_ln_sws_ts.l5	-0.9241	0.2112	-4.38	0.0047

d_ln_dws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	-0.4402	0.3185	-1.38	0.2162
d_ln_cu_ts.l1	-0.2451	0.2125	-1.15	0.2926
d_ln_sws_ts.l1	-0.9792	0.4207	-2.33	0.0588
d_ln_dws_ts.l2	0.2154	0.3344	0.64	0.5433
d_ln_cu_ts.l2	-0.5659	0.2004	-2.82	0.0302
d_ln_sws_ts.l2	0.3584	0.4132	0.87	0.4191
d_ln_dws_ts.l3	0.9739	0.3868	2.52	0.0454
d_ln_cu_ts.l3	-0.1271	0.3031	-0.42	0.6895
d_ln_sws_ts.l3	0.5673	0.3602	1.58	0.1663
d_ln_dws_ts.l4	-0.0812	0.4130	-0.20	0.8506
d_ln_cu_ts.l4	-0.1612	0.3104	-0.52	0.6220
d_ln_sws_ts.l4	-0.1013	0.2985	-0.34	0.7459
d_ln_dws_ts.l5	0.0160	0.3455	0.05	0.9646
d_ln_cu_ts.l5	-0.5395	0.2311	-2.33	0.0583
d_ln_sws_ts.l5	-0.2305	0.2531	-0.91	0.3976

d_ln_sws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_dws_ts.l1	0.1493	0.2311	0.65	0.5422
d_ln_cu_ts.l1	0.1007	0.1542	0.65	0.5381
d_ln_sws_ts.l1	0.3293	0.3053	1.08	0.3222
d_ln_dws_ts.l2	0.2623	0.2427	1.08	0.3212
d_ln_cu_ts.l2	0.4766	0.1455	3.28	0.0169
d_ln_sws_ts.l2	0.2291	0.2999	0.76	0.4739
d_ln_dws_ts.l3	-0.3741	0.2807	-1.33	0.2311
d_ln_cu_ts.l3	0.5633	0.2200	2.56	0.0429
d_ln_sws_ts.l3	-0.1455	0.2614	-0.56	0.5981
d_ln_dws_ts.l4	-0.3742	0.2998	-1.25	0.2584
d_ln_cu_ts.l4	0.0389	0.2253	0.17	0.8685
d_ln_sws_ts.l4	-0.0306	0.2166	-0.14	0.8924
d_ln_dws_ts.l5	-0.0737	0.2508	-0.29	0.7789
d_ln_cu_ts.l5	0.3027	0.1677	1.80	0.1212
d_ln_sws_ts.l5	-0.0783	0.1837	-0.43	0.6850

Table 24: VAR Baseline Model Output MT-Data in 'K'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	-0.6761	0.5552	-1.22	0.2776
d_ln_ws_ts.l1	-1.0325	2.0315	-0.51	0.6329
d_ln_cu_ts.l2	-0.6753	0.7147	-0.94	0.3881
d_ln_ws_ts.l2	0.0909	2.1782	0.04	0.9683
d_ln_cu_ts.l3	-0.3607	0.7398	-0.49	0.6465
d_ln_ws_ts.l3	0.7625	1.9869	0.38	0.7169
d_ln_cu_ts.l4	-0.4493	0.6958	-0.65	0.5470
d_ln_ws_ts.l4	-0.6939	2.0107	-0.35	0.7441
d_ln_cu_ts.l5	0.0184	0.6299	0.03	0.9778
d_ln_ws_ts.l5	1.6436	1.9803	0.83	0.4444
d_ln_cu_ts.l6	-0.1791	0.6017	-0.30	0.7779
d_ln_ws_ts.l6	-0.8429	2.0759	-0.41	0.7015
d_ln_cu_ts.l7	0.0382	0.6246	0.06	0.9536
d_ln_ws_ts.l7	0.6985	2.0146	0.35	0.7429

d_ln_ws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.2977	0.1530	1.95	0.1092
d_ln_ws_ts.l1	0.6572	0.5597	1.17	0.2932
d_ln_cu_ts.l2	0.1505	0.1969	0.76	0.4793
d_ln_ws_ts.l2	-0.0163	0.6001	-0.03	0.9793
d_ln_cu_ts.l3	0.1051	0.2038	0.52	0.6282
d_ln_ws_ts.l3	0.0268	0.5474	0.05	0.9629
d_ln_cu_ts.l4	0.0456	0.1917	0.24	0.8214
d_ln_ws_ts.l4	-0.1415	0.5540	-0.26	0.8086
d_ln_cu_ts.l5	0.0591	0.1735	0.34	0.7472
d_ln_ws_ts.l5	-0.0246	0.5456	-0.05	0.9658
d_ln_cu_ts.l6	-0.1145	0.1658	-0.69	0.5203
d_ln_ws_ts.l6	-0.2879	0.5720	-0.50	0.6361
d_ln_cu_ts.l7	-0.0772	0.1721	-0.45	0.6726
d_ln_ws_ts.l7	-0.1692	0.5550	-0.30	0.7727

Table 25: Estimated A-Matrix of Baseline MT-VAR in 'K'-Ordering

	d_ln_cu_ts	d_ln_ws_ts
d_ln_cu_ts	1	0
d_ln_ws_ts	0.17	1

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Table 26: VAR Alternative Model Output, MT-Data, 'K'-Ordering

d_ln_cu_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.1681	0.1773	0.95	0.3797
d_ln_sws_ts.l1	-0.4939	0.3510	-1.41	0.2090
d_ln_dws_ts.l1	1.0988	0.2657	4.14	0.0061
d_ln_cu_ts.l2	-0.6382	0.1672	-3.82	0.0088
d_ln_sws_ts.l2	0.4821	0.3448	1.40	0.2115
d_ln_dws_ts.l2	-0.6363	0.2790	-2.28	0.0627
d_ln_cu_ts.l3	0.1865	0.2529	0.74	0.4887
d_ln_sws_ts.l3	0.5691	0.3005	1.89	0.1071
d_ln_dws_ts.l3	1.3324	0.3227	4.13	0.0062
d_ln_cu_ts.l4	0.3189	0.2589	1.23	0.2642
d_ln_sws_ts.l4	0.0434	0.2490	0.17	0.8675
d_ln_dws_ts.l4	-0.9523	0.3446	-2.76	0.0327
d_ln_cu_ts.l5	-0.5467	0.1928	-2.84	0.0298
d_ln_sws_ts.l5	-0.9241	0.2112	-4.38	0.0047
d_ln_dws_ts.l5	-0.6756	0.2883	-2.34	0.0576

d_ln_dws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	-0.2451	0.2125	-1.15	0.2926
d_ln_sws_ts.l1	-0.9792	0.4207	-2.33	0.0588
d_ln_dws_ts.l1	-0.4402	0.3185	-1.38	0.2162
d_ln_cu_ts.l2	-0.5659	0.2004	-2.82	0.0302
d_ln_sws_ts.l2	0.3584	0.4132	0.87	0.4191
d_ln_dws_ts.l2	0.2154	0.3344	0.64	0.5433
d_ln_cu_ts.l3	-0.1271	0.3031	-0.42	0.6895
d_ln_sws_ts.l3	0.5673	0.3602	1.58	0.1663
d_ln_dws_ts.l3	0.9739	0.3868	2.52	0.0454
d_ln_cu_ts.l4	-0.1612	0.3104	-0.52	0.6220
d_ln_sws_ts.l4	-0.1013	0.2985	-0.34	0.7459
d_ln_dws_ts.l4	-0.0812	0.4130	-0.20	0.8506
d_ln_cu_ts.l5	-0.5395	0.2311	-2.33	0.0583
d_ln_sws_ts.l5	-0.2305	0.2531	-0.91	0.3976
d_ln_dws_ts.l5	0.0160	0.3455	0.05	0.9646

d_ln_sws_ts

	Estimate	Std. Error	t value	Pr(>|t|)
d_ln_cu_ts.l1	0.1007	0.1542	0.65	0.5381
d_ln_sws_ts.l1	0.3293	0.3053	1.08	0.3222
d_ln_dws_ts.l1	0.1493	0.2311	0.65	0.5422
d_ln_cu_ts.l2	0.4766	0.1455	3.28	0.0169
d_ln_sws_ts.l2	0.2291	0.2999	0.76	0.4739
d_ln_dws_ts.l2	0.2623	0.2427	1.08	0.3212
d_ln_cu_ts.l3	0.5633	0.2200	2.56	0.0429
d_ln_sws_ts.l3	-0.1455	0.2614	-0.56	0.5981
d_ln_dws_ts.l3	-0.3741	0.2807	-1.33	0.2311
d_ln_cu_ts.l4	0.0389	0.2253	0.17	0.8685
d_ln_sws_ts.l4	-0.0306	0.2166	-0.14	0.8924
d_ln_dws_ts.l4	-0.3742	0.2998	-1.25	0.2584
d_ln_cu_ts.l5	0.3027	0.1677	1.80	0.1212
d_ln_sws_ts.l5	-0.0783	0.1837	-0.43	0.6850
d_ln_dws_ts.l5	-0.0737	0.2508	-0.29	0.7789

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Table 27: Estimated A-Matrix of Alternative MT-VAR in 'K'-Ordering

	d_ln_cu_ts	d_ln_sws_ts	d_ln_dws_ts
d_ln_cu_ts	1	0	0
d_ln_sws_ts	0.5449	1	0
d_ln_dws_ts	0.8342	0.4323	1